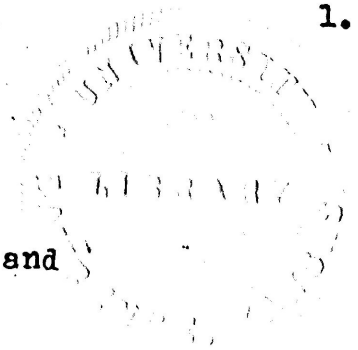

A Comparative study of Intelligence Tests and School Grades

B y

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A. B. Baker University 1915.

Submitted to the Department of Education and the Faculty of the Graduate School of the University of Kansas in partial fulfillment of the requirements for the degree of Master of Arts.

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Date,

June 9, 1921

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The Problem,

One of the problems confronting the school administrator today is, "Can the native intelligence of an individual actually be measured by a system of tests?" Granting for the moment that it can, then it would seem reasonable to conclude that there should exist a relationship between the results of an intelligence test and the sort of work the student is doing in school. Of course we must recognize the fact that there are factors both in and out of school, that influence the quality of student's school work.

However, under ordinary circumstances, a student who has high native intelligence ought to show it by good work in school, and, on the other hand, if he has a lower

degree of intelligence it is important for us to know it, for we ought not expect as much from him.

Thus the relationship, if there be any, that exists between the native intelligence a student possesses and the work he does in school ought to show up with some degree of distinctness if an accurate measurement is made of his native intelligence, and if the results of this measurement are compared with his school work.

The purpose of this thesis is to attempt to discover any such relationship that may exist between the intelligence scores (by the Otis Scale) and the school grades made by the 54 students of the Lansing High School.

Brief Sketch of the Development of Intelligence Tests.

It is not my intention to go into an exhaustive discussion of the history of intelligence tests, for the subject will be dealt with rather briefly. The practical use of intelligence tests is relatively new, in fact, it is only in the last few years that intelligence tests have come into general use.

The idea, that the native intelligence of an individual could be tested in some way and some sort of standard score established, did not present itself to the minds of educators more than perhaps twenty-five or thirty years ago.

The pioneer work along this line was, of course, of a vague and uncertain character for a number of years, for the work was in an entirely new field, and the investigator had no data, or previous labors, from which to start his work. These early studies served their purpose by starting an investigation in a new line of activity that has since borne its fruit.

If we were to make a list of the names of the outstanding educators who have added something to our knowledge of intelligence tests, we could divide them into two general divisions, according to the period of time during which they did their work. The first division would include those who came before the time of Drs. Binet and Simon, of France. The second division would include those who came after Drs. Binet and Simon started their work with intelligence tests.

If we analyze the nature of these investigations, we find that they follow two general methods.

The first method was to give individual tests to a limited number of persons. Among those using this method were Oehrn, Kraeplin, Terman, Wimms, and Binet.

The second method was to use group tests upon a larger number of persons. This method was at first used by Cattell and Galton. Perhaps the first work with intelligence tests was done by Galton of England back in the early eighties.

At an even earlier date than this Galton predicted [1] that it would sometime be possible to obtain a general knowledge of the individual capacities of a man by sinking shafts as it were at a few critical points, [2] meaning by this to test him on some critical subjects. Galton worked out some mental tests and gave them to a large number with the idea of establishing a form and of also trying to find out the cause of the individual variation found in children. In 1883 the results of Galton's work were published in 'Inquiries into the Human Faculty and its Development'. This early work of Galton's was soon followed by other similar workers. In England we find Bryant taking up the work in 1886. He was later followed by Winch, Spearman, W. G. Smith, Wimms, and Burt.

In Germany we find Münsterberg, 1891, Kraepelin, 1896, Aschaffenberg, 1896, Oehrn, 1896, Cron 1897, Cohn, 1898, Stern, 1900, and Wierma, 1902.

(1) Tests for Individual Differences, Mary T. Whitely. The Science Press. New York.

(2) The Intelligence of School Children, Terman, Houghton, Mifflin, New York.

In America the early workers along this line were Cattell, 1890, Bolton 1892, Gilbert, 1893-94, Shaw, 1896, Griffiny, 1896, MacDonald, 1897-8, Kirkpatrick, 1900, Bagley, 1901, Seashore, 1901, Smedley, 1901, Swift, 1903, Gastrow, 1893, Thompson, 1903.

Passing over into the present period, we find, as was said before, that the first outstanding investigators are [1]Drs. Binet and [1]Simon. The advent of these new educators marked a new epoch in the study of intelligence tests. They demonstrated by experimentation that the native intelligence of an individual could actually be measured by a series of tests. They also reduced the tests to more of a standard type than any of the other students had done up to this time. These men carried on a number of experimental tests in the French schools. Their work was first published in 1905 in the 'L'Annee

(1) Tests for Individual Differences, Whitley. The Science Press, New York.

(2) Development of the Intelligence in Children, Binet & Simon Williams, Wilkins, Baltimore.

Psychologique! This publication was brought to America in 1906.

In 1908, Binet and Simon took one hundred children without selection and compared their intelligence standards with their school standing as to the number who were regular, advanced or retarded. They found that the scholastic divergence was greater than the intelligence divergence. In 1906, Terman worked over the Binet Simon scale of intelligence tests making them more adaptable to the use of the American Schools.

In September, 1906, the Vineland research Laboratory for Phychological study of feeblemindedness was opened with Dr. Goddard in charge. Dr. Goddard, at first criticised Binet and Simon's work but later became interested and tried out the tests, worked them over and became a supporter of the general ideas set forth by the tests. Since that time Dr. Goddard has done a great deal of work with intelligence tests in the institution for feebleminded at Vineland.

In 1904, the Yerkes Point Scale was presented to the public. The scale consisted of a single series of tests for measuring the intellectual ability of the student. In 1919, the Otis Group Tests were published. These tests are in

(1) Development of Intelligence in Children, Binet & Simon, Williams, Wilkins Co., Baltimore.

the form of an intelligence scale consisting of ten tests designed to test ~~the~~ different phases of the individual's native intelligence. The Otis Tests, being group tests, are more convenient to give than the individual tests, in that they can be given to a large number of students at a time. At the same time, the Otis Tests contain many of the essential features found in the individual intelligence tests. The Otis tests are the ones that have been used as the basis of this study.

(1) Point Scale for Measuring Mental Ability, Yerkes, Bridges, Hardwick, Baltimore & York, inc. 1915.

(What Others Have Done in The Field)

Several educators have made comparisons in the same general field that this thesis covers. Below will be found a summary of the results of the investigations of some of these workers.

We find that even Binet and Simon recognized the comparison of grades and scores and from their experiments worked out a general rule which is repeated here,

> [1]When a child has a decided brilliant intelligence, he is never behind in his studies and when he has an intelligence decidedly below the medium, he cannot be advanced in his studies. It is especially true that when a child is behind in his studies, he cannot be a brilliant subject and when he is advanced he cannot have a mediocre intelligence.

(1) Development of Intelligence in Children, Binet & Simon, Williams, Wilkins Co., Baltimore.

[1]Bertha M. Smith compared the scores made by high school pupils in reading tests with the general high school grades. She grouped them according to their school grades into upper, middle and lower thirds. The coefficient of correlation of these groups was found with different phases of the reading tests. The results varied from .086 to .684.

[2]John J. B. Morgan in the summary of his studies of the results obtained from giving the army tests to seventy-four of the best men from the officers' training camp, says, "The army work has shown that it does not pay to take a chance on a man's intelligence."

[3]W. D. Armentrout and James M. Glass gave the Otis scale to 397 Junior High School pupils and grouped them into classes according their intelligence quotients. From the grouping they judged there would be a close correlation between the teachers' estimates and the intelligence quotients.

(1) School Review Sept. '19 p. 493-511.
(2) School and Society 9:247-Feb.22'19.
(3) School Review 28, 249-52.

[1]J. N. Madsen gives some interesting results obtained by giving the army tests to the highschool pupils of the South Omaha High School. The scores thus obtained were compared with the school grades. The students were divided into clases. There were 203 in the Freshman Class and they showed a coefficient of correlation of .20. The 82 Sophomores had a coefficient of correlation of .48. The 74 Juniors had a coefficient of correlation of .37. The 69 Seniors had a coefficient of correlation of .469. This shows a considerably higher coefficient of correlation for the Lansing High School than for the Omaha High School but on the other hand not so many individuals were involved in the Lansing comparison.

[2]Mary M. Wentworth gives the results of the Army Alpha Tests in the Hollywood High School. This comparison involves a group of 211 students who were Seniors in the high school. This comparison gave a coefficient of correlation of .428 with teachers' estimates. Another comparison was made with the scores and the grades on the grade cards of this same group of students and a coefficient of correlation of .546 was obtained.

(1) School and Society 11:625 - 27.
(2) School and Society 12:58 -60 Jl 10,20.

[1]William H. Smith gave the Otis Group Tests to 89 eighth grade students of the East Orange School in June 1919. The next year he found the coefficient of brightness of forty-nine of these students who entered high school, and compared their coefficient with the grades they made in their high school subjects and a coefficient of correlation of .53 was obtained.

[2]Terman found a coefficient of correlation of .45 between the intelligence quotients of 504 students and their school work.

[2]King, while at Beloit College, using the opposite tests on 56 engineer Freshmen, got a coefficient of correlation of .26 with their scholastic standing. K. T. Waugh got a coefficient of correlation of .84 between intelligence tests and class standing.

[2]Marie Hackel Means, using the scores from an opposite test of one hundred words given to 73 students and their psychology grades, secured a coefficient of correlation of .54.

(1) School and Society 12:71-2 Jl 17'20.

(2) Journal of Educational Psychology M 1920, p. 137-50.

W. M. Proctor[1] found a coefficient of correlation of .45 between the mental age and school marks of 111 Students of the Palo Alto High School. California. He found the coefficient of correlation between the intelligence quotients and school work to be .545.

Dr. June Downey[2] gave intelligence tests to the students in her psychology class in the University of Wyoming and found there was a coefficient of correlation of .527 between the scores made and her own class estimate.

From a study of the foregoing facts, we see that the results secured by the investigators mentioned show a ~~very~~ close correlation between the class of school work the individuals were doing and their intelligence scores. Although different investigators used different sets of intelligence tests still the results were generally the same in that a good correlation was found to exist between the scores and the school work.

(1) Intelligence of School Children, Terman.
(2) Intelligence of School Children, Terman. Houghton, Mifflin Co. New York.

~~work.~~ Even Binet pointed out that the results of a reliable intelligence test will define the possible limitations of attainment the individual is capable of making. The others do not state such a conclusion in so many words, still the coefficient of correlation they obtained would bear out Binet in his statement. The number of these investigators who have compared the scores and school work seems to be great enough to preclude the possibility that the coefficient of correlation is the result of mere chance.

Then if this be so, and the data seem to indicate that it is, there must be a definite relation existing between the intelligence scores a student makes and his school marks. In order to confirm this statement by a personal study of the intelligence scores and school grades made by the students in my own school this thesis was undertaken. How well I have succeeded in the experiment will be brought out in the later pages.

Method of Procedure of Securing Data.

After the general subject of this thesis had been chosen, the Otis Tests were, on Oct. 16, 1919, given to the students of the Lansing High School. The papers were graded and the results worked out during the year. The idea was to give the intelligence tests in the fall and then see what relation existed between the test scores and the school grades the students had made for the entire year. In other words to see if one can predict at the beginning of the school year by means of the test scores about what sort of school work the student will do during the year. This being the general plan it was necessary to wait until the close of the school year in order to secure the grades for the entire school year. The term 'student's grade' in this study means the average of all of the grades the student received in his various school subjects for the year. Suppose for example a student made the following grades during the year, Algebra 80%, History 74%, General Science 78% and English 72%. We find that the average of these four grades will amount to 76%. Hence 76 would be considered the student's school grade in this thesis.

After the grades were averaged ~~the various school groups were selected and~~ a study was made of the relationship existing between the grades and scores. The relationship existing in each of these groups was shown not only by the coefficient of correlation but also by graphical representation. The method of securing the coefficient of correlation and the method of plotting the graphs will be explained later. In a way similar to the above a comparison was made between the grade I.B.s and score I.B.s of the same groups. The letters 'I.B.' stand for the Index of Brightness. A good example of the meaning of this term is given in Otis Manuel for 1920. A brief summary of this will be given here. Otis states that there are two aspects of a child's mental ability, one his degree of intelligence and the other his degree of brightness. Intelligence refers to the child's degree of mental development or mental maturity, that is, how far his mentality has progressed. It is measured by the score the pupil makes in his intelligence tests. On the other hand brightness simply refers to the relation of the student's intelligence to that of the others of his own age. The so called normal individual progresses in mental growth at such a rate that each year he attains a score just equal to the norm for that age.

That is according to the Otis table of norms his score at eight years of age will be 40 points, at nine years of age it will be 52 points and so on until at 18 it will have reached 130 points. At this age he is supposed to have as high a native intelligence as he ever will have. Now if 1000 children of say 10 years taken at random are examined they will be found to have a wide range of scores running from almost nothing to nearly 150 points. But their median will be 64 and the middle half of the scores will range from 44 to 84.

If 1000 individuals of some other age higher than this be taken, say 14 we will find another wide range of scores with a median of 112. Here again the middle half will range from about 20 below to 20 above the median score. The cause of this wide range of scores of the pupils of the same age is due to the fact some pupils have an innate capacity for greater achievement than others. Otis calls this innate capacity brightness. The greater this capacity for mental development the greater the degree of brightness. The normal child will exceed just half of those of his own age in intelligence. Now if a student secures a score of 25 points above the norm for his age he has an "Increment of Score" of 25 points. If his score falls below the norm for his age by 25 points he has a "Decrement of Score" of 25 points. Either of

these is a deviation from the norm. Those who have an increment of score are brighter than the norm and those who have a decrement of score are duller than the norm. Hence the individual deviation from the norm is a measure of his degree of brightness. In order to escape the plus and minus sign another measure the 'Index of Brightness' is used. Let an index of brightness of 100 represent normality. If an individual has an increment of score of 25 points, 25 is added to 100 giving him an index of brightness of 125. On the other hand if he has decrement of score of 25 points, 25 is subtracted from 100 making his index of brightness 75. Hence the rule "The index of brightness of an individual of any age is found therefore by adding to 100 the number of points by which his score exceeds the norm for his age or by subtracting from 100 the number of points by which his score falls below the norm for his age." Since the norm for an adult (Any individual of 18 years or over) is 130 points an adult's index of brightness is obtained by adding to or subtracting from 100 the number of points by which his score exceeds or falls below 130 points. An adult making a score of 170 for example would have an index of brightness of 140'. The index of brightness was found for the school

grades first then for the test scores. To do this the student's grades were arranged according to rank. Then the percentile rank of each student was found, which is the percent of the whole number of students which each student outranks. As there were 54 students in all then for any individual there were 53 other students besides himself. Suppose for instance a student has secured a grade that is above that of 25 of his comrades. Then his percentile rank is 25/53 or .47 which means he outranks .47 of his comrades. The percentile rank of .47 can be translated into terms of index of brightness by referring to a table given in Otis Manual for 1920 which shows it to be 98. (The table is reproduced on the following page.) Then tables were worked out by a method to be explained later showing a coefficient of correlation of the index of brightness for the grades and scores. In order to make the working out of the data for the various groups more convenient the names of the students were arranged alphabetically and each student given a serial number. These serial numbers were listed in order, and opposite each number were arranged in their respective orders the age, school grade, test score, grade I.B. and test score I.B.

Table taken from Otis Manual 1920 edition showing the correspondence between the percentile rank and the Index of Brightness.

I.B.	P.R.	I.B.	P.R.	I.B.	P.R.
0	0.04	20	0.35	40	2.2
I	0.045	21	0.39	41	2.3
2	0.05	22	0.42	4	2.5
3	0.055	23	0.47	43	2.7
4	0.06	24	0.52	44	2.9
5	0.07	25	0.57	45	3.2
6	0.08	26	0.63	46	3.4
7	0.09	27	0.69	47	3.7
8	0.10	28	0.76	48	4.0
9	0.11	29	0.83	49	4.3
10	0.12	30	0.91	50	4.6
11	0.13	31	1.0	51	4.9
12	0.15	32	1.1	52	5.3
13	0.17	33	1.2	53	5.6
14	0.19	34	1.3	54	6.0
15	0.21	35	1.4	55	6.5
16	0.23	36	1.6	56	6.9
17	0.26	37	1.7	57	7.3
18	0.29	38	1.8	58	7.8
19	0.32	39	2.0	59	8.3

I.B.	P.R.	I.B.	P.R.	I.B.	P.R.
60	8.9	83	28	106	58
61	9.4	84	29	107	59
62	10.0	85	31	108	61
63	10.6	86	32	109	62
64	11.2	87	33	110	63
65	11.9	88	34	111	64
66	12.6	89	36	112	66
67	13.3	90	37	113	67
68	14.0	91	38	114	68
69	14.8	92	39	115	69
70	15.6	93	41	116	71
71	16.4	94	42	117	72
72	17.2	95	43	118	73
73	18	96	45	119	74
74	19	97	46	120	75
75	20	98	47	121	76
76	21	99	49	122	77
77	22	100	50	123	78
78	23	101	51	124	79
79	24	102	53	125	80
80	25	103	54	126	81
81	26	104	55	127	82
82	27	105	57	128	82.8

I.B.	P.R.	I.B.	P.R.	I.B.	P.R.
129	83.6	147	94.4	165	98.6
130	84.4	148	94.7	166	98.7
131	85.2	149	95.1	167	98.8
132	86.0	150	95.4	168	98.9
133	86.7	151	95.7	169	99
134	87.4	152	96	170	99.1
135	88.1	153	96.3	171	99.17
136	88.8	154	96.6	172	99.24
137	89.4	155	96.8	173	99.31
138	90.0	156	97.1	174	99.37
139	90.6	157	97.3	175	99.43
140	91.1	158	97.5	176	99.48
141	91.7	159	97.7	177	99.53
142	92.2	160	97.9	178	99.75
143	92.7	161	98	179	99.61
144	93.1	162	98.2	180	99.65
145	93.5	163	98.3		
146	94	164	98.5		

Description of the Tabulations

On the pages immediately following will be found lists of the data collected in this study of intelligence tests.

The list of the student's data gives each student's serial number, age, class, grade test score, class grade I.B. and test score I.B. This places all the student's individual data in a compact form.

Following the student's data we find a list of all the coefficients of correlation that were obtained from the comparisons of the school groups that were studied.

After this list comes the tabulation of the data for each of the comparisons from which the coefficients of correlation were obtained.

Student's Individual Data.

Student's Serial Number	Student's Age	Ave. School Grade	Test Score	Grade I.B.	Score I.B.
1	15	94 3/4	192	180	180
2	16	91	151	126	139
3	19	89 1/5	131	115	116
4	15	86 4/5	108	106	93
5	17	80 3/4	126	74	107
6	16	81 3/4	133	83	118
7	15	77 4/5	90	64	67
8	16	83 3/5	109	93	96
9	15	92 1/5	138	139	126
10	17	89	106	113	88
11	16	84 2/5	103	96	85
12	14	84 1/2	106	98	88
13	17	92 1/5	109	142	96
14	14	88	138	111	126
15	14	70	99	38	80
16	17	91 3/5	145	130	136
17	15	82 1/4	140	88	128
18	16	85 3/4	99	101	80
19	15	84 1/4	86	95	53
20	18	90 3/5	160	120	153

Serial Number	Students Age	School Grade	Test Score	Grade I.B.	Score I.B.
21	16	78 1/2	90	69	67
22	15	90 1/5	134	118	122
23	16	91 3/5	129	133	112
24	17	94	162	161	161
25	18	88 3/4	120	112	105
26	15	75 3/4	111	61	99
27	20	89 2/5	113	116	101
28	17	81	129	79	112
29	17	85 1/2	98	99	76
30	16	82 1/2	101	89	83
31	15	87	94	108	74
32	15	72 1/2	53	47	38
33	15	87 1/5	91	109	69
34	15	80 1/4	107	71	91
35	15	80 3/4	104	76	86
36	19	81	129	77	112
37	15	63 1/2	38	0	0
38	17	93 2/5	159	147	147
39	17	86 1/5	108	103	93
40	19	83	144	90	133
41	15	81	117	81	104
42	15	82 1/4	98	86	76

Serial Number	Students Age	School Grade	Test Score	Grade I.B.	Score I.B.
43	15	73	92	53	71.
44	18	91 3/5	154	128	142.
45	16	83 1/2	74	92	47
46	18	86	90	102	67.
47	14	93 1/2	113	153	101
48	19	90 3/5	133	122	118
49	15	86 2/5	141	105	130
50	16	81 3/4	122	84	106
51	18	74 1/4	81	57-	53
52	14	78	109	67	96
53	18	91 4/5	127	136	109
54	14	91	133	125	118

Table A

Coefficients of correlation computed between the school grades and the intelligence scores for the various school groups.

Table number	Number of students	Group.	Coefficient of correlation
I	54	Entire H. S.	.650 ± .053
2	6	Age 14	.624 ± .111.
3	18	Age 15	.741 ± .810.
4	10	Age 16	.569 ± .334.
5	9	Age 17	.498 ± .169.
6	6	Age 18	.676 ± .150.
7	5	Age 19-20	—.362 ± .262.
8	7	Average each year	.483 ± .195.
9	15	Junior-Senior girls	.451 ± .013.
10	23	Freshman-Soph. girls	.506 ± .104.
11	6	Junior-Senior boys	—.496 ± .203.
12	9	Freshman-Spho. boys	.763 ± .093.
13	38	H. S. Girls	.739 ± .049.
14	15	H. S. Boys	.687 ± .089.
15	14	Senior Class	.469 ± .140.
16	7	Junior Class	.429 ± .208.
17	14	Soph. Class	.870 ± .043.
18	19	Freshman Class	.696 ± .079.

Table A (Continued)

Coefficient of correlation computed between the school grade I.B.'s and the test score I.B.'S for the various groups.

Table number	Number of students.	Group	Coefficient of correlation
19	54	Entire H. S.	.671 ± .050.
20	6	Age 14	.686 ± .145.
21	18	Age 15	.717 ± .077.
22	10	Age 16	.290 ± .195.
23	9	Age 17	.798 ± .081.
24	6	Age 18	.795 ± .101.
25	5	Age 19 and 20	-.264 ± .280.
26	7	Average each yr.	.349 ± .224.
27	15	Junion-Sr.Girls	.530 ± .122.
28	23	Fresh-Soph. "	.503 ± .099.
29	6	Junior-Sr. boys	-.790 ± .103.
30	9	Fresh-Soph.boys	.766 ± .093.
31	38	H.S.Girls	.689 ± .057.
32	15	H.S.Boys	.588 ± .113.
33	14	Senior Class	.580 ± .119.
34	7	Junior Class	.752 ± .110.
35	14	Sophomore Class	.463 ± .090.
36	19	Freshman Class	.903 ± .056.

Explanation of the Tables That Follow.

Tables I to XVIII inclusive were developed from the class grades and the intelligence test scores of the various groups reported. Tables XIX to XXXVI inclusive deal with the class grade I.B.'s (see page 18) and the test score I.B.'s of the same student groups.

To simplify the statement of class grade and test score divisions in these tables the following plan has been employed: The students class grades which ranged from 63.5 to 94.75 were divided into eight equal intervals and each one numbered and recorded as follows:

Interval No.	1	2	3	4	5	6	7	8
Includes Grades	63-66	67-70	71-74	75-78	79-82	83-86	87-90	91-94

The scores for the intelligence test ranged from 38 to 192 for these same pupils. These scores were divided into eleven equal divisions or intervals as follows:

Interval No.	1	2	3	---------	to	11
Scores	38-51	52-65	66-79			178-191

In a similar way the class grade I.B.'s whose range is from 0 to 180; and the test score I.B.'s whose range is from 0 to 180, are each divided into ten equal intervals.

Table I.

A Correlation of the school grades and the test scores for the entire high school. The school grades are arranged in horizontal rows, the test scores in vertical columns.

Class Grades / Test scores	1	2	3	4	5	6	7	8	9	10	11	Totals
8											1	1
7					1	1	6	3	3			14
6			1	3	5	2	2	1				14
5				1	7	2	4	2				16
4				2	1	1						4
3		1		2	1							4
2												
1	1											1
Totals	1	1	1	8	15	6	12	6	3	0	1	54

Coefficient of correlation $.650 \pm .053$.

In table I all the students of Lansing High School are included. There are 54 in all and the Coefficient of Correlation between the class grades and test scores is, $.650 \pm .053$.

Table II.

A correlation of the school grades and the test scores for the age 14 group. The school grades are arranged in horizontal rows, the test scores in vertical columns.

Class Grades \ Test Scores	1	2	3	4	5	6	7	8	9	Totals
8				1				1		2
7									1	1
6										
5			1							1
4										
3			1							1
2										
1	1									1
Totals	1	0	2	1	0	0	0	1	1	6

Coefficient of correlation. $.624 \pm .111$.

In table 11 all the students in the high school of age 14 are included. There are six students in the group. The Coefficient of correlation between the class grades and test scores is $.624 \pm .111$. The group is too small, for a much greater danger of chance errors in the value of the coefficient found for so small a group. This observation may be repeated for several of the tables following this one.

Table 111.

A correlation of the school grades and the test scores for the age 15 group. The school grades are arranged in horizontal rows, the test scores in vertical columns.

Class Grades / Test Scores	1	2	3	4	5	6	7	8	9	10	11	Totals
7							2				1	3
6				2	1			1				5
5				1	3	1		1				6
4				1		1						2
3		1		1								2
2												0
1	1											1
Totals	1	1	0	5	4	2	2	3	0	0	1	19

Coefficient of correlation .741 $\pm$.069.

In table 111 all the students in the high school of age 15 are included. There are 18 students in the group. The Coefficient of correlation between the class grades and test scores is, .741 $\pm$.069. This is the highest correlation found among the different age groups also has the largest number of students involved.

Table 1V.

A Correlation of the school grades and the test scores for the age 16 group. The school grades are arranged in horizontal rows, the test scores in vertical columns.

Class Grades / Test Scores	1	2	3	4	5	6	7	8	9	Totals
8						1			1	2
7										0
6										0
5										0
4	1		1	2						4
3				1		1	1			3
2										0
1			1							1
Totals	1	0	2	3	0	2	1	0	1	10

Coefficient of correlation .569 ± .334.

In table 1V all the students in the high school of age 16 are included. There are 10 students in the group. The Coefficient of correlation between the class grades and test scores is, .569.

Table V.

A correlation of the school grades and the test scores for the age 17 group. The school grades are arranged in horizontal rows, the test scores in vertical columns.

Class Grades / Test Scores	1	2	3	4	5	6	7	8	9	Totals
8									1	1
7		1						1		2
6						1				1
5		1								1
4		1								1
3	1									1
2										0
1				2						2
Totals	1	3	0	2	0	1	0	1	1	9

Coefficient of correlation .498 $\pm$.169.

In table V all the students in the high school of age 17 are included. There are 9 students in the group. The Coefficient of correlation between the class grades and test scores is, .498.

Table Vl.

A correlation of the school grades and the test scores for the age 18 group. The school grades are arranged in horizontal rows, the test scores in vertical columns.

Class Grades / Test Scores	1	2	3	4	5	6	7	8	Totals
9					1			2	3
8				1					1
7	1								1
6									0
5									0
4									0
3									0
2									0
1	1								1
Totals	2	0	0	1	1	0	0	2	6

Coefficient of correlation .676 $\pm$ .150.

In table Vl all the students in the high school of age 18 are included. There are six students in the group. The Coefficient of correlation between the class grades and test scores is .676.

Table V11.

A Correlation of the school grades and the test scores - for the age 19 and 20 group. The school grades are arranged in horizontal rows, the test scores in vertical columns.

Class Grades \ Test Scores	1	2	3	4	5	6	7	8	Totals
6						1			1
5	1				1				2
4									0
3									0
2								1	1
1					1				1
Totals	1	0	0	0	2	1	0	1	5

Coefficient of correlation $-.362 \pm .262$.

In table V11 all the students in the high school of ages 19-20 are included. There are 5 students in the group. The coefficient of correlation between the class grades and test scores is, -.362. This is the only negative found among the different age groups. The observation regarding smallness of group made for table II also applies here.

Table V111.

A Correlation of the school grades and the test scores for the averages for each year. The school grades are arranged in horizontal rows, the test scores in vertical columns.

Class Grades	Test Scores 1	2	3	4	5	6	7	8	9	10	Totals
9			1								1
8						1	1				2
7										1	1
6				1							1
5	1										1
4											0
3											0
2											0
1		1									1
Totals	1	1	1	1	0	1	1	0	0	1	7

Coefficient of correlation .483 $\pm$.195.

Table V111 contains the averages of the class grades and test scores for all the students in each of the year groups.

The Coefficient of correlation between the class grades and the test scores is .483.

Table IX.

A correlation of the school grades and the test scores for the Junior and Senior girls group. The School grades are arranged in horizontal rows, the test scores in vertical columns.

Class Grades / Test Scores	1	2	3	4	5	6	7	8	9	10	Totals
8							1			1	2
7							1				1
6				1		3	1				5
5		2		1							3
4		1				1					2
3	1										1
2											0
1			1								1
Totals	1	3	1	2	0	4	3	0	0	1	15

Coefficient of correlation .451 ±.013.

In table IX all the Junior and Senior girls of the high school are included. There are 15 girls in the group. The Coefficient of correlation between the class grades and the test scores is, .451.

Table X.

A Correlation of the school grades and the test scores for the Freshman and Sophomore girls group. The school grades are arranged in horizontal rows, the test scores in vertical columns.

Class Grades	Test Scores 1	2	3	4	5	6	7	8	9	Totals
8					1		1	1	1	4
7									1	1
6			2	1	1					4
5	1			2	2		1			6
4				1			1			2
3			2		1					3
2			1		1					2
1				1						1
TOTALS	1	0	5	5	6	0	3	1	2	23

Coefficient of Correlation .506 $\pm$.104.

In table X all the Freshman and Sophomore girls of the high school are included. There are 23 girls in the group; The Coefficient of correlation between the class grades and test scores is, .506

Table Xl.

A correlation of the school grades and the test scores for the Junior and Senior boys group. The school grades are arranged in horizontal rows, the test scores in vertical columns.

Class Grades / Test Scores	1	2	3	4	5	6	7	8	9	Totals
7	1									1
6							1		1	2
5										0
4										0
3										0
2							2		1	3
1										0
Totals	1	0	0	0	0	0	3	0	2	6

Coefficient of correlation $-.496 \pm .203$.

In table Xl all the boys in the Junior and Senior classes are included. There are 6 students in the group. The Coefficient of correlation between the class grades and test scores is, -.496. This table and table Vll are the only ones that have a negative Coefficient of correlation.

Table XII.

A correlation of the school grades and the test scores for the Freshman and Sophomore boys group. The school grades are arranged in horizontal rows, the test scores in vertical columns.

Class Grades / Test Scores	1	2	3	4	5	6	7	8	9	10	11	Totals
8									1			1
7						2						2
6						1		1			1	3
5												0
4		1			1							2
3												0
2												0
1	1											1
Totals	1	1	0	0	1	3	0	1	1	0	1	9

Coefficient of correlation .763±.093..

In table XII all the boys in the Freshman and Sophomore classes are included. There are 9 students in the group. The Coefficient of correlation between the class grades and test scores is, .763. This is the highest Coefficient of correlation in the entire eighteen tables.

Table XIII.

A correlation of the school grades and the test scores for the high school girls group. The school grades are arranged in horizontal rows, the test scores in vertical columns.

Class Grades / Test Scores	1	2	3	4	5	6	7	8	9	10	Totals
9								1		1	2
8				1	2	2	2	1-			8
7			1	1	1	2		1			6
6		2	4			1					7
5			4								4
4			1	1	2						4
3		2	1								3
2		1		1							2
1			1								1
Totals	0	5	8	8	5	5	2	3	0	1	37

Coefficient of correlation .739 $\pm$ .049.

In table XIII all the girls in the high school are included. There are 38 students in the group. The Coefficient of correlation between the class grades and test scores is, .739.

Table XIV.

A correlation of the school grades and the test scores for the high school boys group. The school grades are arranged in horizontal rows, the test scores in vertical columns.

Class Grades \ Test Scores	1	2	3	4	5	6	7	8	9	Totals
9						1				1
8							1	2		3
7					2					2
6						2		3	1	6
5										0
4		1		1						2
3										0
2										0
1	1									1
Totals	1	1	0	1	2	3	1	5	1	15

Coefficient of correlation .687 $\pm$.089.

In table XIV all the boys in the high school are included. There are 15 students in the group. The coefficient of correlation between the class grades and test scores is, .687.

Table XV.

A correlation of the school grades and the test scores for the high school Senior group. The school grades are arranged in horizontal rows, the test scores in vertical columns.

Class Grades / Test Scores	1	2	3	4	5	6	7	8	Totals
8								1	1
7		1					1		2
6				1	1		1	1	4
5			1		1				2
4		1				1			2
3	1								1
2						1			1
1				1					1
Totals	1	2	1	2	2	2	2	2	14

Coefficient of correlation .469 $\pm$.140.

In table XV the entire Senior class of the high school are included. There are 14 students in the group. The Coefficient of correlation between the class grades and the test scores is, .469.

Table XVI.

A correlation of the school grades and the test scores for the Junior group. The school grades are arranged in horizontal rows, the test scores in vertical columns.

Class Grades	Test Scores 1	2	3	4	5	6	7	8	9	Totals
8									1	1
7										0
6			1	1	1					3
5	1									1
4										0
3										0
2										0
1			2							2
Totals	1	0	3	1	1	0	0	0	1	7

Coefficient of correlation .429 $\pm$.208.

In table XVI the entire Junior class of the high school are included. There are 7 students in the group. The Coefficient of correlation between the class grades and test scores is, .429.

Table XVll.

A correlation of the school grades and the test scores for the Sophomore class group. The school grades are arranged in horizontal rows, the test scores in vertical columns.

Class Grades	Test Scores 1	2	3	4	5	6	7	8	9	Totals
8									1	1
7							1			1
6			2		1	1				4
5	1	1		1	1					4
4				2						2
3										0
2					1					1
1			1							1
Totals	1	1	3	3	3	1	1	0	1	14

Coefficient of correlation .870 $\pm$.043

In table XVll the entire Sophomore class of the high school are included. There are 14 students in the group. The Coefficient of correlation between the class grades and test scores is, .870.

Table XVlll.

A correlation of the school grades and the test scores for the Freshman class group. The school grades are arranged in horizontal rows, the test scores in vertical columns.

Class Grades	Test Scores 1	2	3	4	5	6	7	8	9	Totals
8							1	1		2
7					1				1	2
6						2				2
5						3	1	2		6
4					2	1				3
3		1		1						2
2						1				1
1	1									1
Totals	1	1	0	1	3	7	2	3	1	19

Coefficient of correlation $.696 \pm .079$.

In table XVlll the entire Freshman class of the high school are included. There are 19 students in the group. The Coefficient of correlation between the class grades and test scores is, .696.

Table XlX.

A correlation of the grade I.B. and test score I.B. for the enitre high school group. The school grade I.B.'s are arranged in horizontal rows, the test score I.B.'s in vertical columns.

Class Grades / Test Scores	1	2	3	4	5	6	7	8	9	10	Totals
10										1	1
9						1			2		3
8						1	2	4			7
7				1	2	2	4	1	1		11
6			2	1	4	3		2			12
5					3	3	3	1			10
4			1	2		3					6
3			1	1	1						3
2											0
1	1										1
Totals	1	0	4	5	10	13	9	8	3	1	54

Coefficient of correlation .671 $\pm$.050.

In table XlX all the students of the high school are included. There are 54 in all and the Coefficient of correlation between the class grades I.B. and test scores I.B.'s is, .671.

Table XX.

A correlation of the school grade I.B.'s and the test score I.B.'s for the age 14 group. The school grade I.B.s are arranged in horizontal rows, the test scores I.B.'s in vertical columns.

Class Grades	Test Scores 1	2	3	4	5	6	7	8	9	10	Totals
10					1						1
9											0
8								1			1
7										1	1
6		1									1
5											0
4											0
3				1							1
2											0
1	1										1
Totals	1	1	0	1	1	0	0	1	0	1	6

Coefficient of correlation .686 $\pm$ .145.

In table XX all the students in the high school of age 14 are included. There are six students in the group. The Coefficient of correlation between the class grades I.B. and test scores I.B.'s, is. .68. Here again the number of cases is extremely small. This of course tends to condition the significance of the coefficient found.

Table XXl.

A correlation of the school grade I.B.'s and the test score I.B.'s for the age 15 group. The school grade I.B's are arranged in horizontal rows, the test score I.B's in vertical columns.

Class Grades / Test Scores	1	2	3	4	5	6	7	8	9	10	Totals
10										1	1
9											0
8								1			1
7				1	1		1				3
6			1			1		1			3
5					2	1		1			4
4				1		2					3
3			1	1							2
2											0
1	1										1
Totals	1	0	2	3	3	4	1	3	0	1	18

Coefficient of correlation .717 $\pm$.077.

In table XXl all the students in the high school of age 15 are included. There are 18 students in the group. The Coefficient of correlation between the class grades I.B's and test scores I.B's is. .717.

Table XXll.

A correlation of the school grade I.B's and the test score I.B's for the age 16 group. The school grade I.B's are arranged in horizontal rows, the test score I.B's in vertical columns.

Class Grades / Test Scores	1	2	3	4	5	6	7	8	9	10	Totals
10							1				1
9										1	1
8											0
7											0
6				1							1
5	1				1	1					3
4				1							1
3							1	1			2
2											0
1			1								1
Totals	1	0	1	2	1	1	2	1	0	1	10

Coefficient of correlation .290 ±.195.

In table XXll all the students in the high school of age 16 are included. There are 10 students in the group. The Coefficient of correlation between the class grades I.B. and test scores I.B's is, .29.

Table XXlll.

A correlation of the school grade I.B's and the test score I.B!s for the age 17 group. The school grade I.B's are arranged in horizontal rows, the test score I.B's in vertical columns.

Class Grades / Test Scores	1	2	3	4	5	6	7	8	9	10	Totals
10										1	1
9											0
8			1					1			2
7							1				1
6											0
5		1									1
4			1								1
3	1										1
2											0
1				1	1						2
Totals	1	1	2	1	1	0	1	1	0	1	9

Coefficient of correlation. 798 $\pm$.081.

In table XXlll all the students in the high school of age 17 are included. There are 9 students in the group. The Coefficient of correlation between the class grades I.B's and test scores I.B's is, .798.

Table XXIV.

A correlation of the school grade I.B's and the test scores I.B's for the age 18 group. The school grade I.B's are arranged in horizontal rows, the test scores I.B's in vertical columns.

Class Grades	Test Scores 1	2	3	4	5	6	7	8	9	10	Totals
10											0
9						1					1
8									1		1
7										1	1
6						1					1
5		1									1
4											0
3											0
2											0
1	1										1
Totals	1	1	0	0	0	2	0	0	1	1	6

Coefficient of correlation .795 ±.101

In table XXIV all the students in the high school of age 18 are included. There are 6 students in the group. The Coefficient of correlation between the class grades I.B's, and test scores I.B's is .795

Table XXV.

A correlation of the school grade I.B's and the test score I.B's for the age 19 and 20 group. The school grade I.B's are arranged in horizontal rows, the test score I.B's in vertical columns.

Class Grade	Test Scores 1	2	3	4	5	6	7	8	9	10	Totals
10											0
9											0
8							1				1
7					1		1				2
6											0
5											0
4											0
3										1	1
2											0
1						1					1
Totals	0	0	0	0	1	1	2	0	0	1	5

Coefficient of correlation $-.264 \pm .280$

In table XXV all the students in the high school of age 19-20 are included. There are 5 students in this group. The Coefficient of correlation between the class grades I.B's and test scores I.B's, is, -.264.

Table XXVl

A correlation of the school grade I.B's and the test score I.B's for the average age group. The school grade I.B's are arranged in horizontal rows, the test score I.B's in vertical columns.

Class Grades \ Test Scores	1	2	3	4	5	6	7	8	9	10	Totals
10											0
9					2						2
8											0
7						1					1
6											0
5					1					1	2
4			1								1
3											0
2											0
1		1									1
Totals	0	1	1	0	3	1	0	0	0	1	7

Coefficient of Correlation .349 ±.224.

Table XXVl contains the averages of the class grades and test scores for all the students in each year groups. The Coefficient of correlation between the class grades I.B's and test scores I.B's is, .349.

Table XXVll.

A correlation of the school grade I.B's and the test scores I.B's for the Junior and Senior girls group. The school grade I.B's are arranged in horizontal rows, the test score I.B's in vertical columns.

Class Grades	Test Scores 1	2	3	4	5	6	7	8	9	10	Totals
10										1	1
9											0
8								1			1
7							1				1
6											0
5						2	1	1			4
4		1	1	1	1						4
3	1	1			1						3
2						1					1
1											0
Totals	1	2	1	1	2	3	2	2	0	1	15

Coefficient of correlation .530 ±.122.

In table XXVll all the Junior and Senior girls of the high school are included. There are 15 students in the group. The Coefficient of correlation between the class grades I.B's and test scores I.B's is, .530.

Table XXVIII.

A correlation of the school grade I.B's and the test score I.B's for the Freshman and Sophomore girls group. The school grade I.B's are arranged in horizontal rows, and the test score I.B's in vertical columns.

Class Grades / Test Scores	1	2	3	4	5	6	7	8	Totals
10						1			1
9								1	1
8							2		2
7								1	1
6			1	2	2				5
5	1			2	1				4
4					1	2			3
3			2		1				3
2			1			1			2
1					1				1
Totals	1	0	4	4	6	4	2	2	23

Coefficient of correlation .503 $\pm$.099.

In table XXVIII all the Freshman and Sophomore girls of the high school are included. There are 23 students in the group. The Coefficient of correlation between the class grades I.B's and test scores I.B's is, .503.

Table XXlX

A correlation of the school grade I.B's and the test score I.B's for the Junior and Senior boys group. The school grade I.B's are arranged in horizontal rows, the test score I.B's are in vertical columns.

Class Grades / Test Scores	1	2	3	4	5	6	7	8	9	10	Totals
10			1								1
9					1						1
8											0
7						1					1
6											0
5											0
4											0
3											0
2											0
1						3					3
Totals	0	0	1	0	1	4	0	0	0	0	6

Coefficient of Correlation -.790 ±.103.

In table XXlX all the Junior and Senior boys of the high school are included. There are six students in the group. The Coefficient of correlation between the class grades I. B's and test scores I.B's is, -.79.

Table XXX

A correlation of the school grade I.B's and the test score I.B's for the Freshman and Sophomore boys group. The School grade I.B's are arranged in horizontal rows, the test score I.B's in vertical columns.

Class Grades	Test Scores 1	2	3	4	5	6	7	8	9	10	Totals
10											0
9									1		1
8					1	1					2
7						1					1
6								1			1
5					1						1
4				1							1
3											0
2											0
1	1										1
Totals	1	0	0	1	2	2	0	1	1	0	8

Coefficient of correlation .766 ±.093.

In table XXX all the Freshman and Sophomore boys of the high school are included. There are 9 students in the group. The Coefficient of correlation between the class grades I.B and test scores I.B. is, .766.

Table XXXI.

A correlation of the school grade I.B's and the test score I.B's for the high school girls group. The school grade I.B's are arranged in horizontal rows, the test score I.B's in vertical columns.

Class Grades / Test Scores	1	2	3	4	5	6	7	8	9	10	Totals
10										1	1
9									1		1
8					1			1			2
7						2	3	1			6
6				1	1	2	1	1			6
5			3	5			1				9
4	1			1	2		1				5
3			1	1	2						4
2			2		1						3
1				1							1
Total	1	0	6	9	7	4	6	3	1	1	38

Coefficient of correlation .689 ±.057.

In table XXXI all the high school girls in the high school are included. There are 38 students in the group. The Coefficient of correlation between the class grades I.B's and test score I.B's is, .689.

Table XXXll.

A correlation of the school grade I.B's and the test score I.B's for the high school boys group. The school grade I.B's are arranged in horizontal rows, the test score I.B's in vertical columns.

Class Grades	Test Scores 1	2	3	4	5	6	7	8	9	Totals
9						1	1			2
8							1			1
7							1			1
6				1	1					2
5					1	1	3	1		6
4			1	1						2
3										0
2										0
1	1									1
Totals	1	0	1	2	2	2	6	1	0	15

Coefficient of correlation .588 $\pm$.112.

In table XXXll all the high school boys in the high school are included. There are 15 students in the group. The Coefficient of correlation between the class grades I.B's and test scores I.B's, is, .588.

Table XXXlll.

A correlation of the school grade I.B's and the test score I.B's for the Senior class group. The school grade I.B's are arranged in horizontal rows, the test score I.B's in vertical columns.

Class Grade	Test Scores 1	2	3	4	5	6	7	8	9	10	Totals
10										1	1
9									1		1
8			1								1
7				1							1
6					1			1	1		3
5			1				1				2
4			1				1				2
3	1										1
2							1				1
1					1						1
Totals	1	0	3	1	2	0	3	1	2	1	14

Coefficient of correlation .580 $\pm$.119.

Table XXXlll contains the entire Senior class of the high school. There are 14 students in the group. The Coefficient of correlation between the class grade I.B's and the test score I.B's is, .58.

Table XXXlV

A correlation of the school grade I.B's and the test score I.B's for the Junior class group. The school grade I.B's are arranged in horizontal rows, the test score I.B's in vertical columns.

Class Grade	Test Scores 1	2	3	4	5	6	7	8	9	10	Totals
10										1	1
9											0
8											0
7											0
6											0
5						2					2
4	1			1							2
3											0
2											0
1				2							2
Totals	1	0	0	3	0	2	0	0	0	1	7

Coefficient of correlation .752 ±.110.

Table 34 includes the entire Junior class of the high school. There are 7 students in the group. The Coefficient of correlation between the class grade I.B's and test scores I.B'S is, .752.

Table XXXV

A correlation of the school grade I.B's and the test score I.B's for the Sophomore class group. The school grade I.B's are arranged in horizontal rows, the test score I.B's in vertical columns.

Class Grades	Test Scores 1	2	3	4	5	6	7	8	9	10	Totals
10								1	1		2
9											0
8							1				1
7			1	1	1	1					4
6	1	1				1					3
5				1					1		2
4											0
3						1					1
2			1								1
1											0
Totals	1	1	2	2	1	3	1	1	2	0	14

Coefficient of correlation .463 $\pm$.090.

Table XXXV includes the entire Sophomore class of the high school. There are 14 students in the group. The Coefficient of correlation between the class grades I.B's and test score I.B's is, .463.

Table XXXVl.

A correlation of the school grade I.B's and the test score I.B's for the Freshman class group. The school grade I.B's are arranged in horizontal rows, the test score I.B's are in vertical columns.

Class Grades	Test Scores. 1	2	3	4	5	6	7	8	9	10	Totals
10							1				1
9											0
8								1			1
7					1	2		1			4
6						1	2				3
5					2	2	2				6
4				1							1
3			1			1					2
2											0
1	1										1
Totals	1	0	1	1	3	6	5	2	0	0	19

Coefficient of correlation .903 ±.056.

Table XXXVl includes the entire Freshman class of the high school. There are 19 students in the group. The Coefficient of correlation between the class grade I.B's and test score I.B's is, .903.

Description of the Graphs.

A number of graphs have been prepared using the data in the preceding tables. These graphs like the tables show the relationship between the intelligence test scores and the school grades. The tables show the relationship in terms of the coefficient of correlation while the graphs give a graphical representation of this same relationship. In all these graphs the same color represents the same thing, that is, the green line in all cases represents the school grades while the red line represents the intelligence scores.

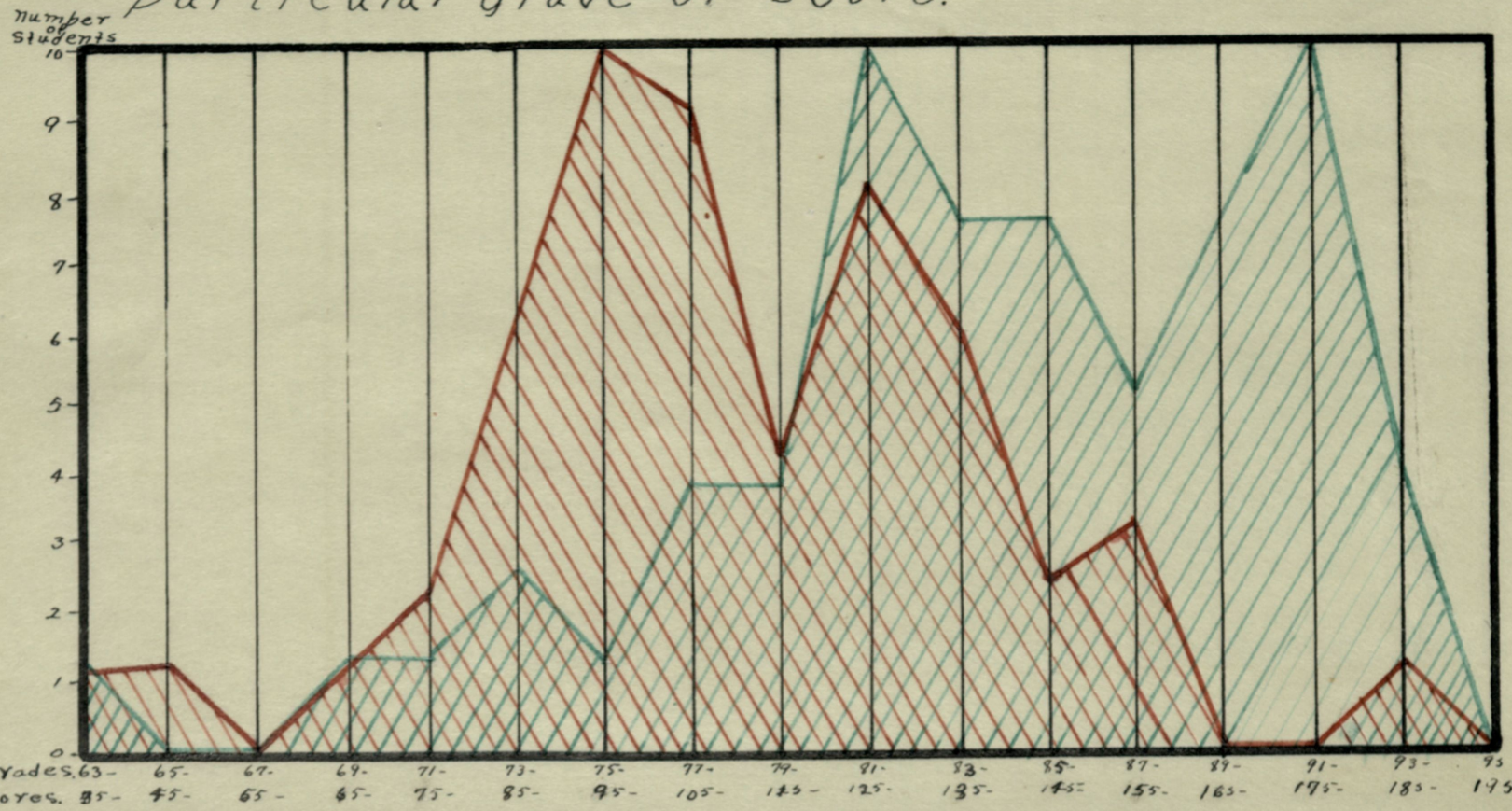
Graph A shows the relationship between the grades and scores when each is listed from the lowest to the highest. Taking the grades first the graph was divided into divisions each division representing a certain grade, the lowest being at the left the highest at the right. Then the height the green reaches on any one division shows how many students secured that particular grade. The scores were then listed in a similar manner.

The remaining 36 graphs are classified 1,2,3 etc. 1 is a graphical representation of the data given in Table 1, graph 2 of the data given in Table 2 and so on throughout the list.

Each graph contains as many vertical lines as there are students in the group. The school grades of the group were arranged in ascending order from the lowest to the highest and are represented by the green line. Each individual student's grade and score are shown on the same vertical line, the height on the line showing the size of the grade and score. The closeness with which the red line follows the green represents the closeness of the relationship of the scores with the grades.

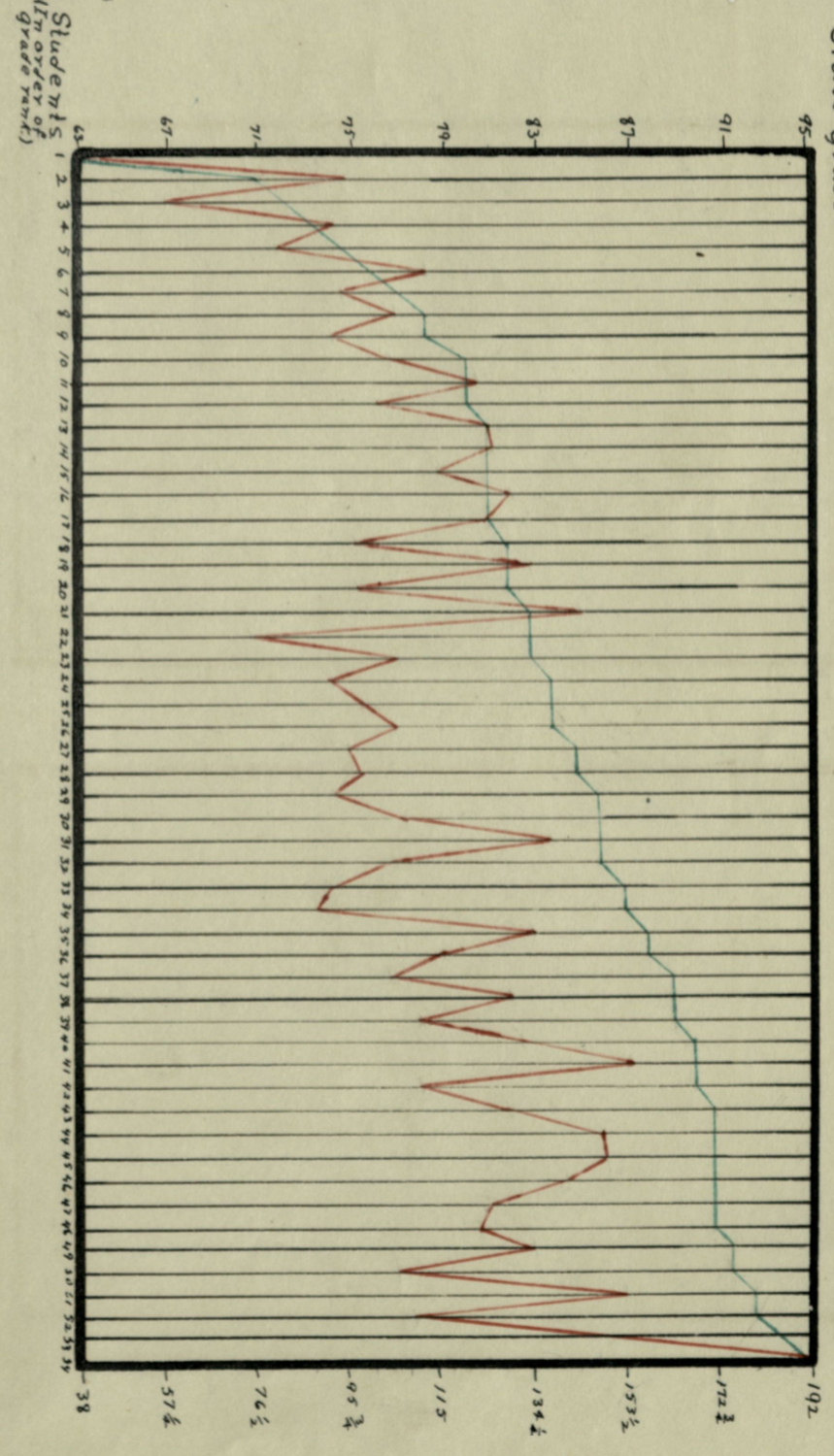
The scale divisions for school grades and test scores are not the same in all the graphs that follow. Thus the graphs are not intended to be comparable one with another. They indicate only the comparison involved in the graph itself in each case.

The red line represents the test score, the green line the school grade. The height at which they cut the vertical lines indicates the number receiving that particular grade or score.



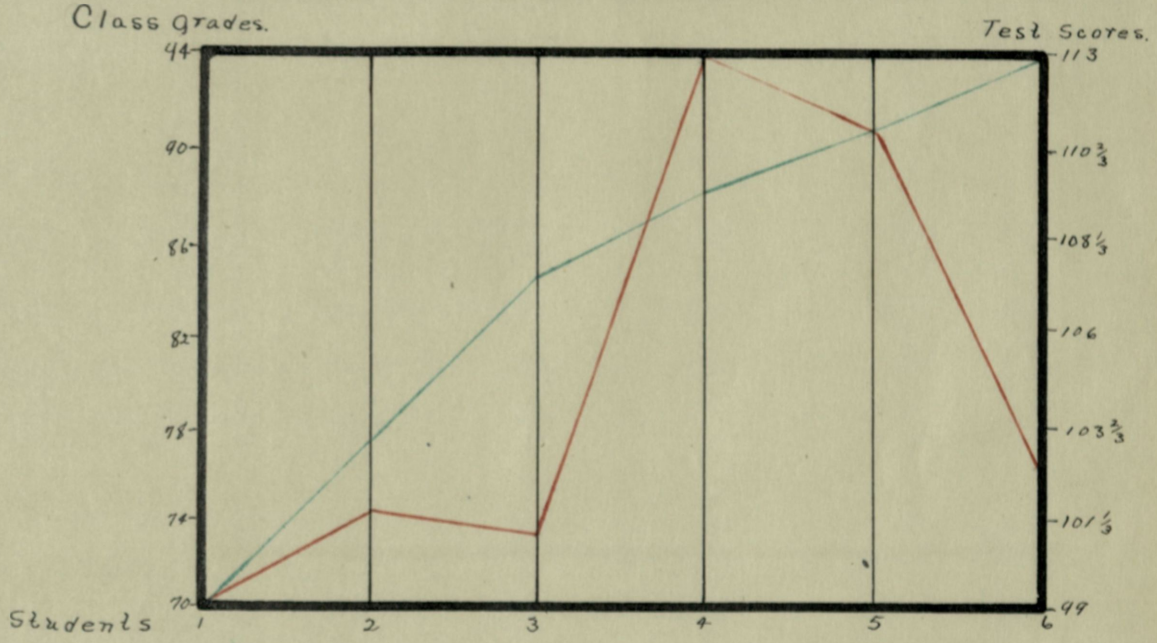
GRAPH A – ENTIRE HIGH SCHOOL.

The red line represents the test scores, the green the school grades. The height at which they cut the vertical lines indicate the grade and score made by each student in the group.

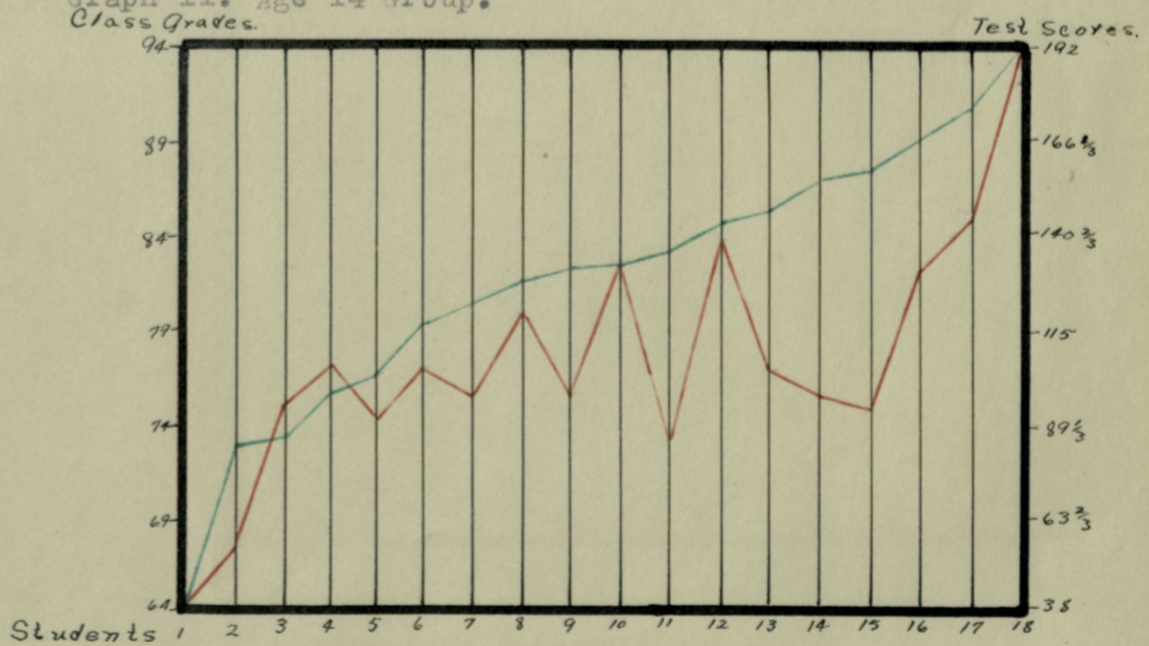


GRAPH I. ENTIRE HIGH SCHOOL GROUP.

The red line represents the test score, the green the school grade. The height at which they cut the vertical lines indicate the grade and score made by each student in the group.

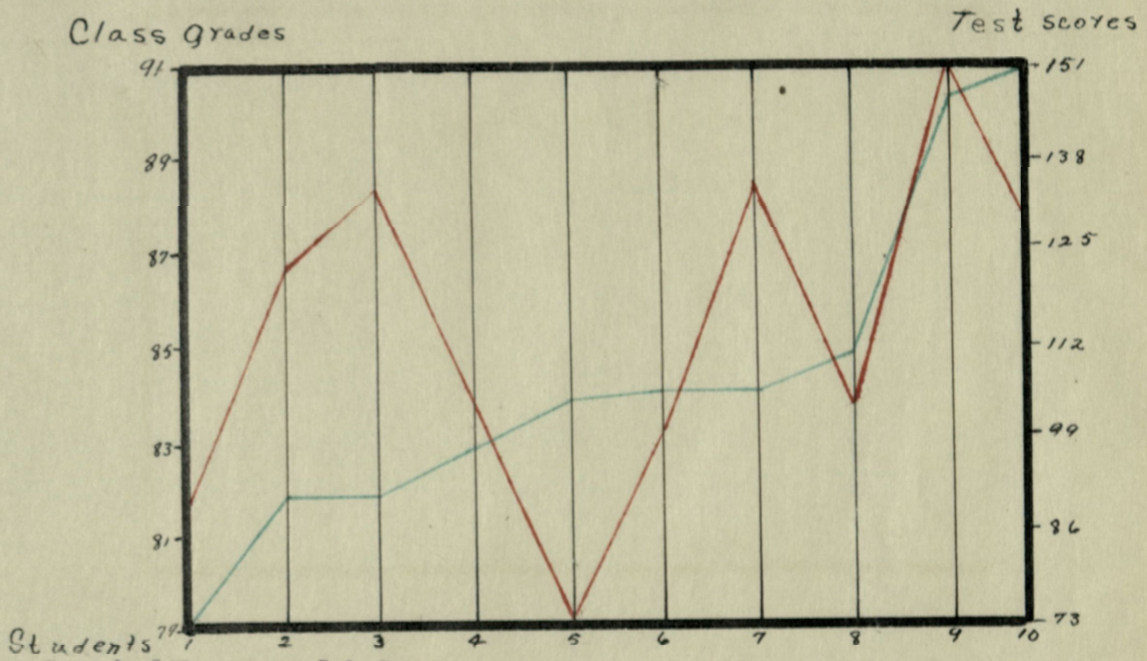


Graph 11. Age 14 Group.

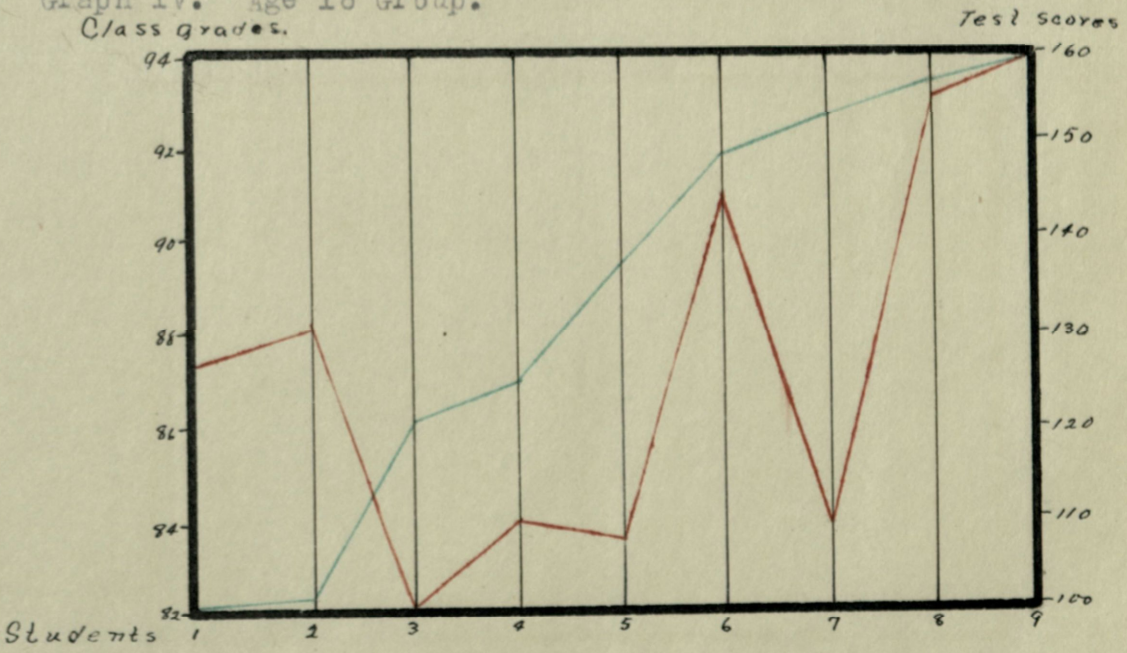


Graph 111. Age 15 Group.

The red line represents the test score, the green the school grade. The height at which they cut the vertical line indicates the grade and score made by each student in the group.

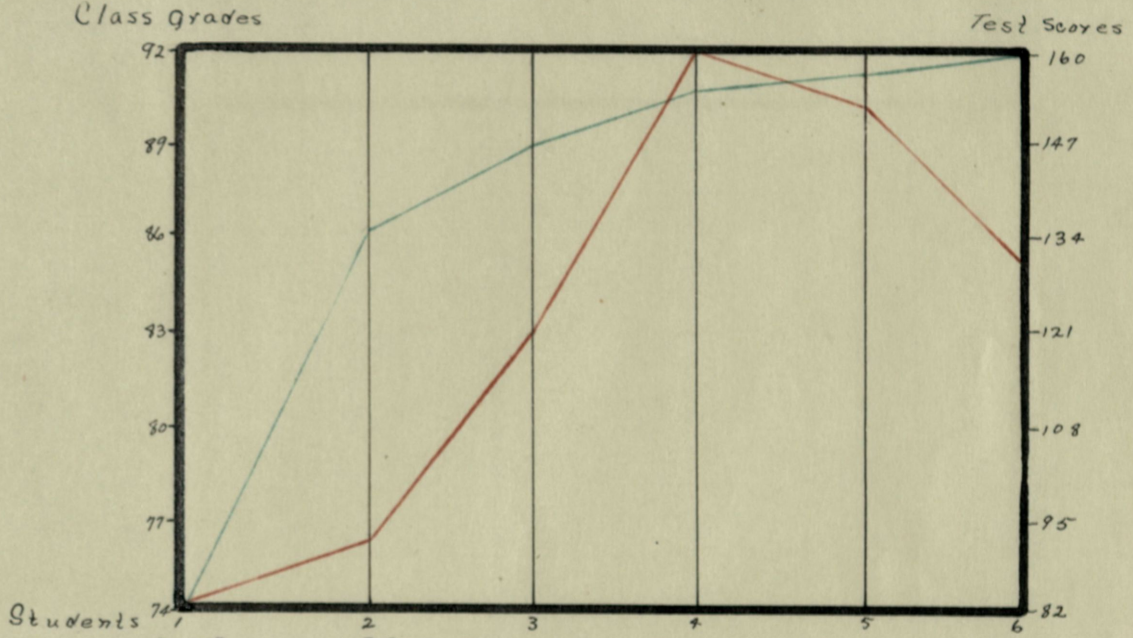


Graph IV. Age 16 Group.

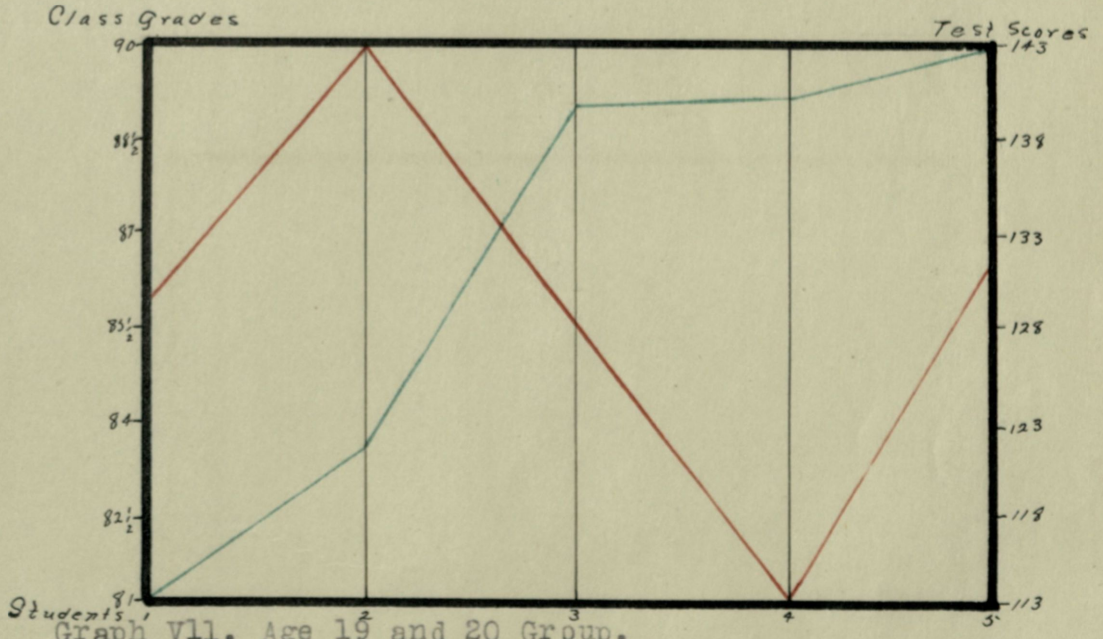


Graph V. Age 17 Group.

The red line represents the test score, the green the school grade. The height at which they cut the vertical line indicates the grade and score made by each student in the group.

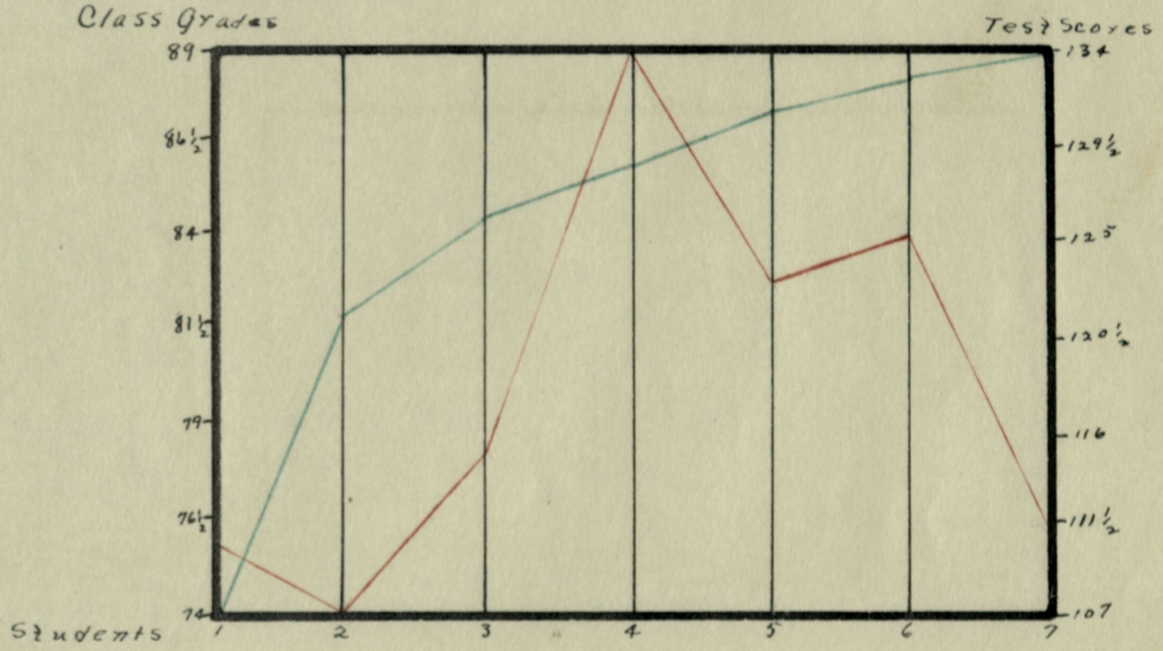


Graph Vl. Age 18 Group.

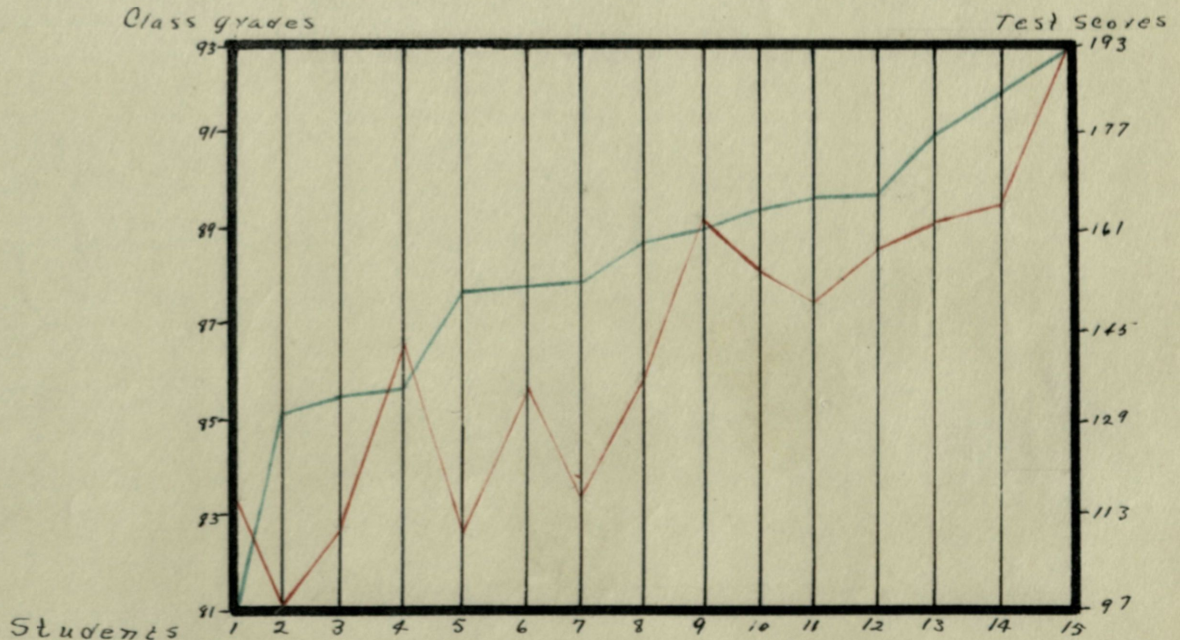


Graph Vll. Age 19 and 20 Group.

The red line represents the test score, the green the school grade. The height at which they cut the vertical line indicates the grade and score made by each student in the group.

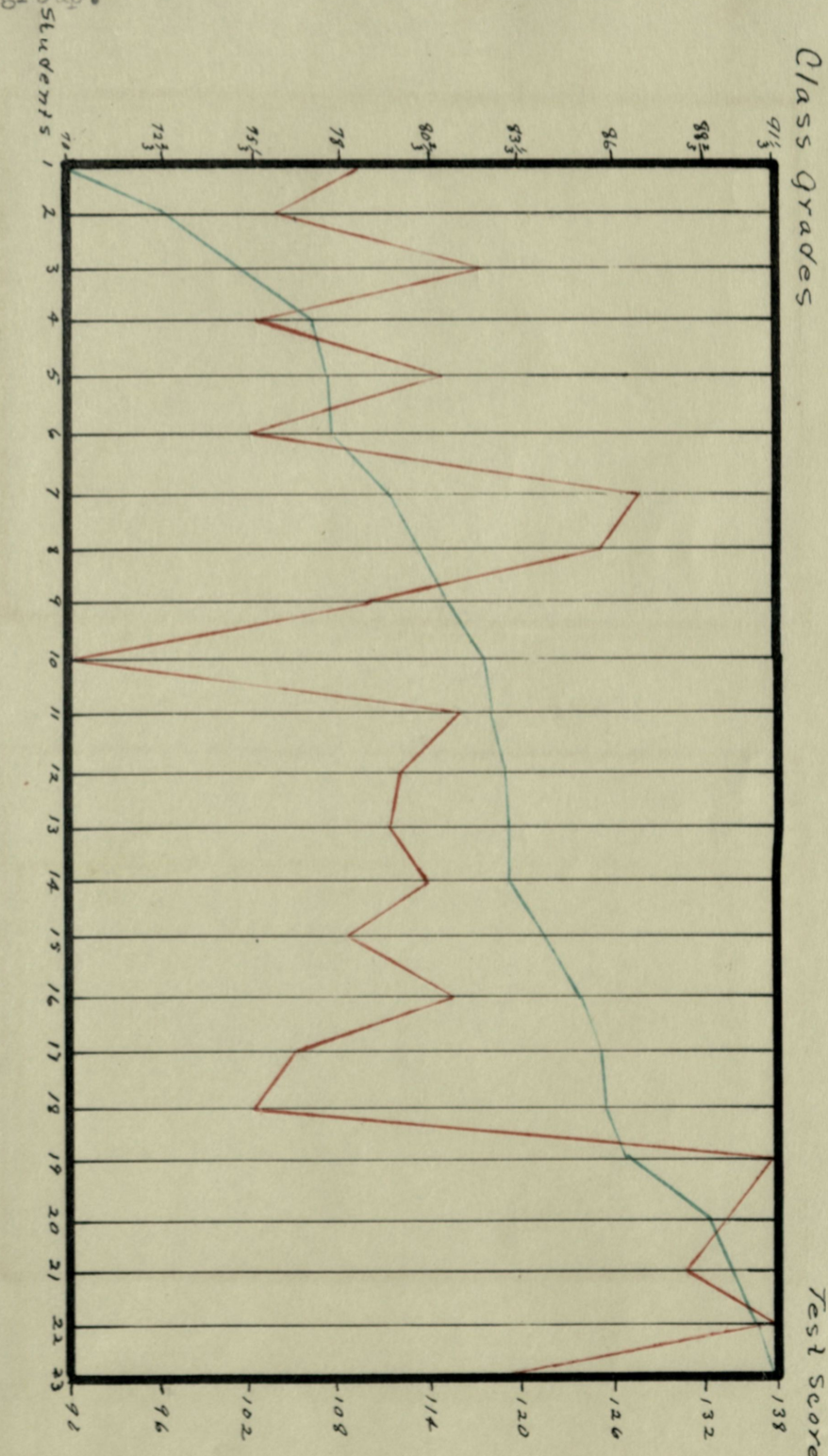


Graph VIII. Average for each of 6 age groups.



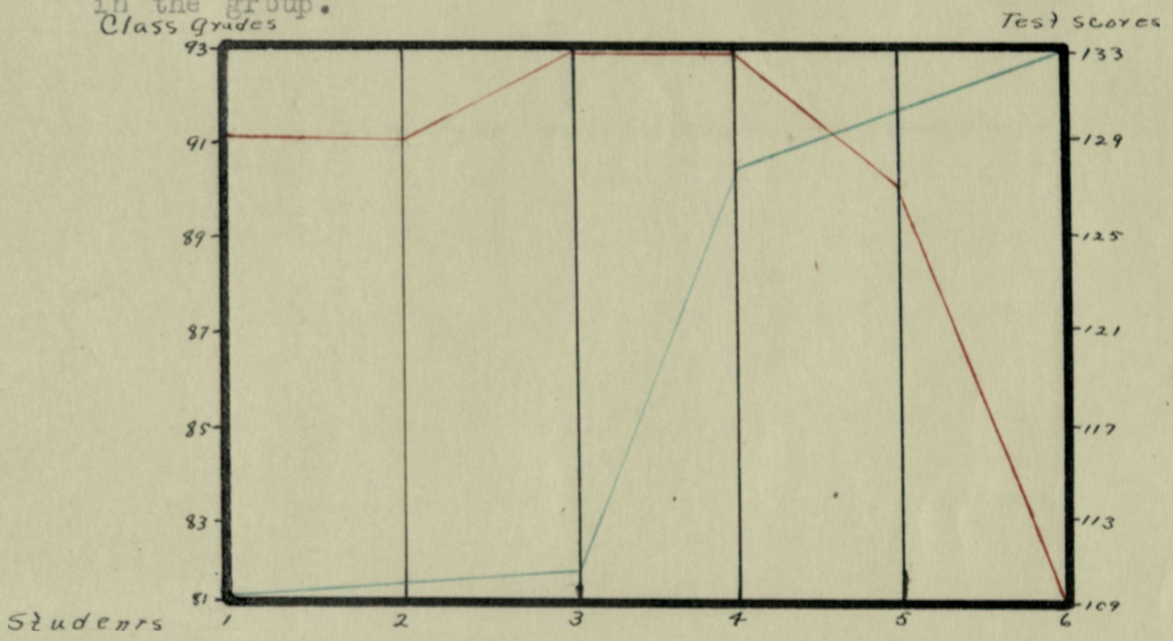
Graph IX. Junior and Senior Girls.

The red line represents the test score, the green the school grade. The height at which they cut the vertical line indicates the grade and score made by each student in the group.

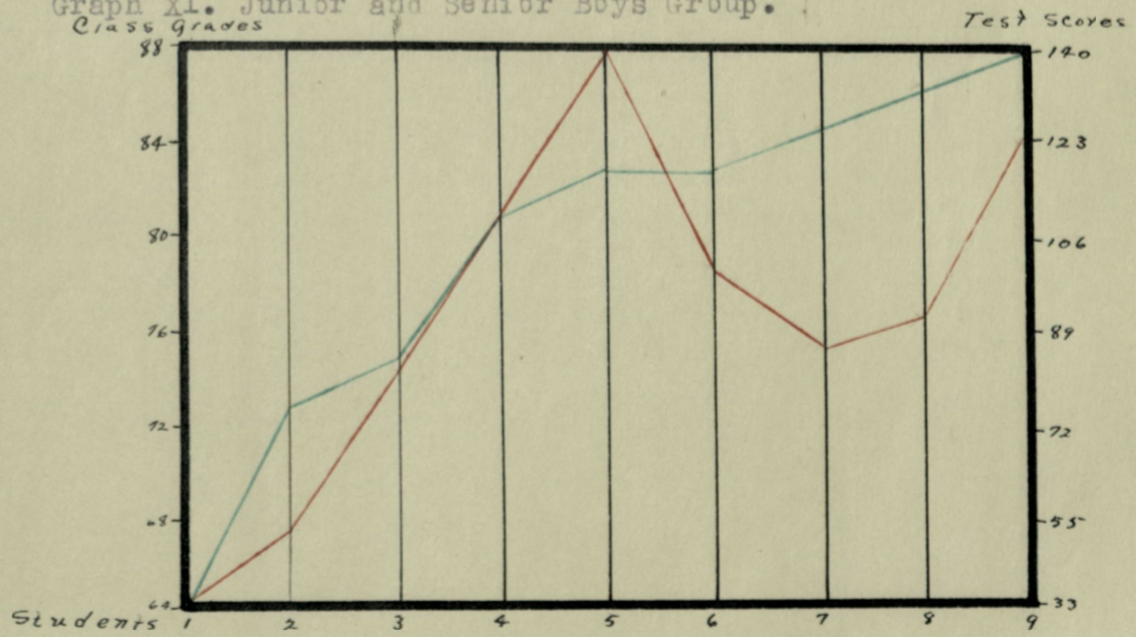


GRAPH X. FRESHMAN-SOPHMORE GIRLS GROUP.

The red line represents the test score, the green the school grade. The height at which they cut the vertical line indicates the grade and score made by each student in the group.

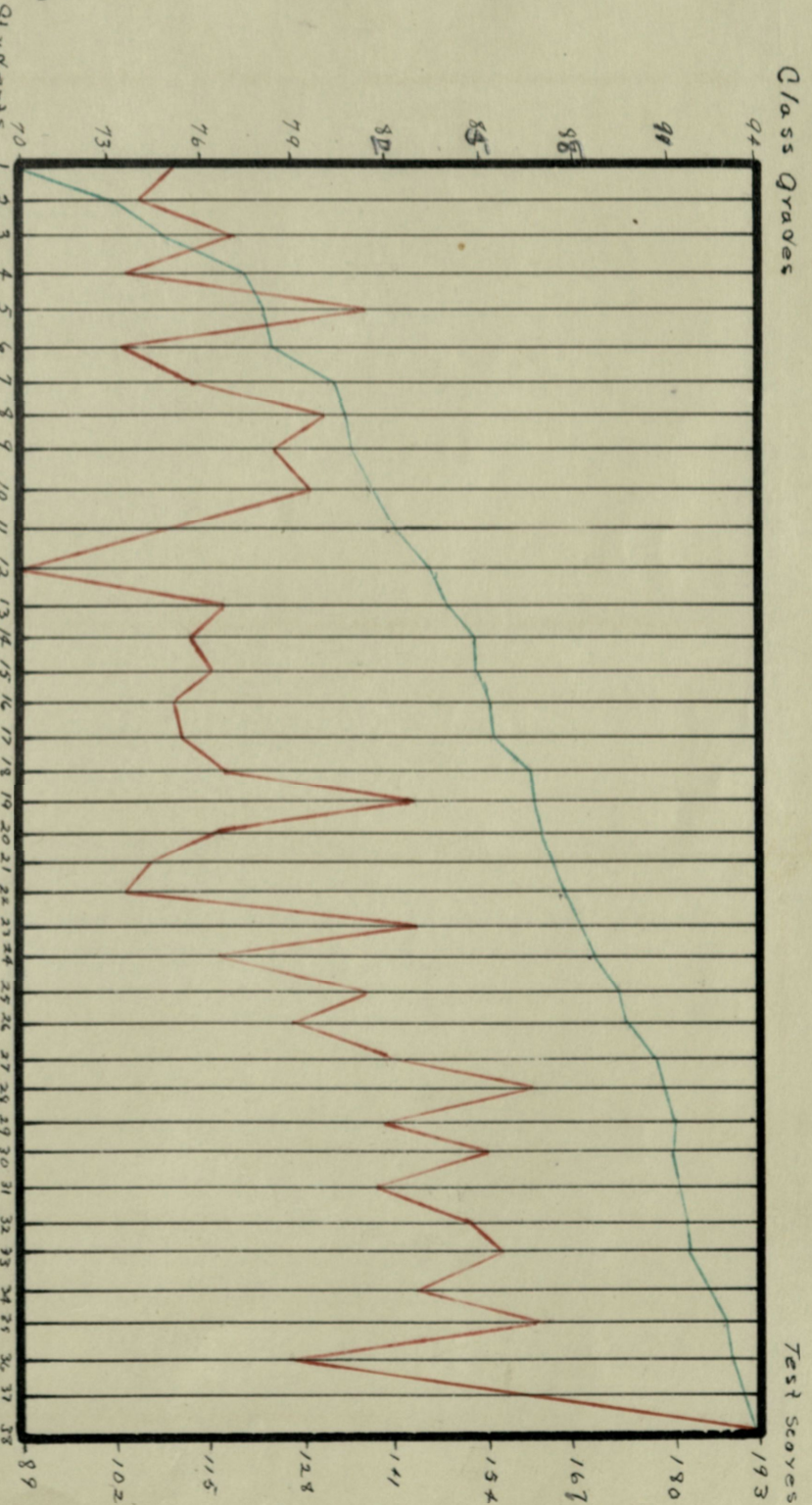


Graph Xl. Junior and Senior Boys Group.



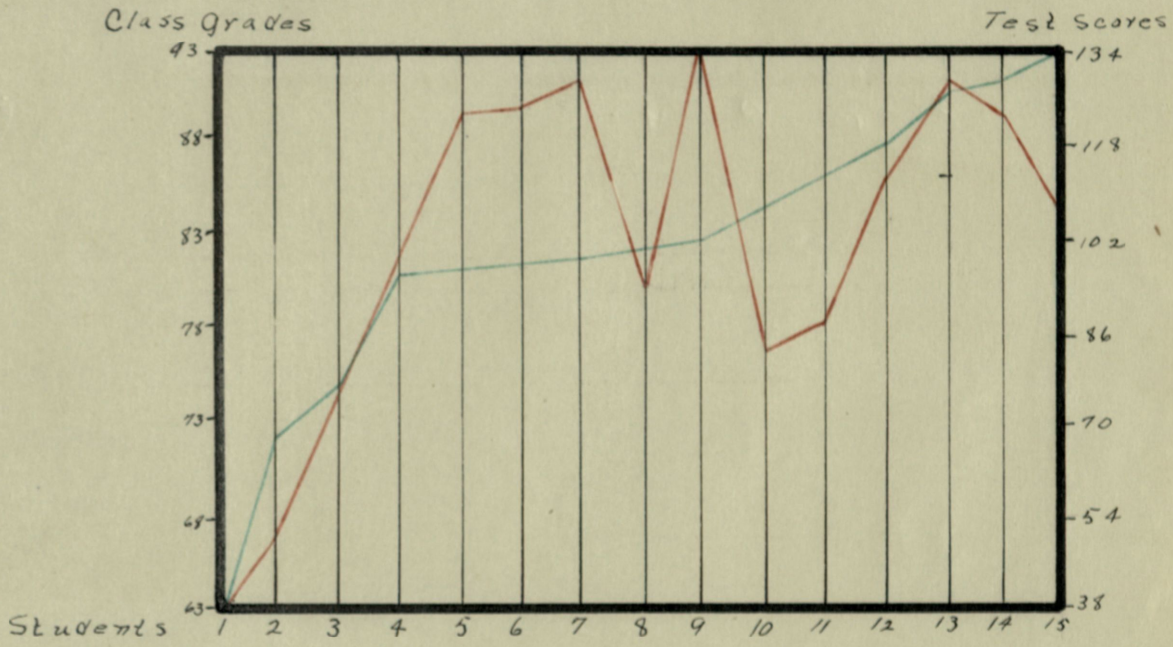
Graph Xll. Freshman and Sophomore Boys Group.

The red line represents the test score, the green the school grade. The height at which they cut the vertical line indicates the grade and score made by each student in the group.

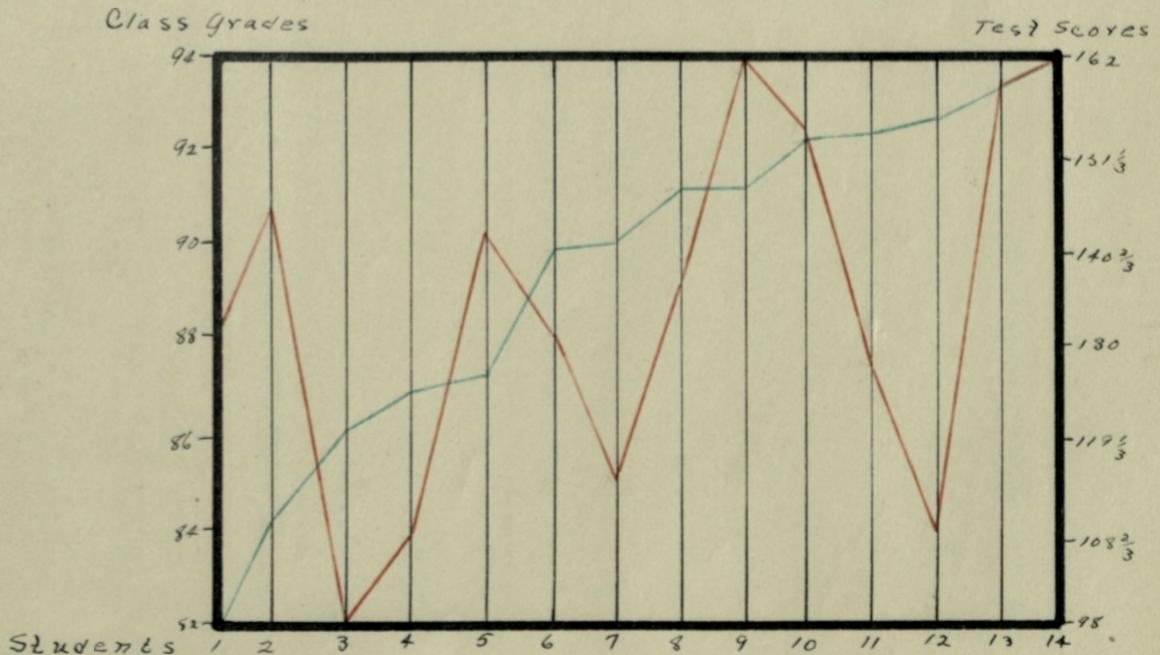


GRAPH XIII- HIGH SCHOOL GIRLS GROUP.

The red line represents the test score, the green the school grade. The height at which they cut the vertical line indicates the grade and score made by each student in the group.

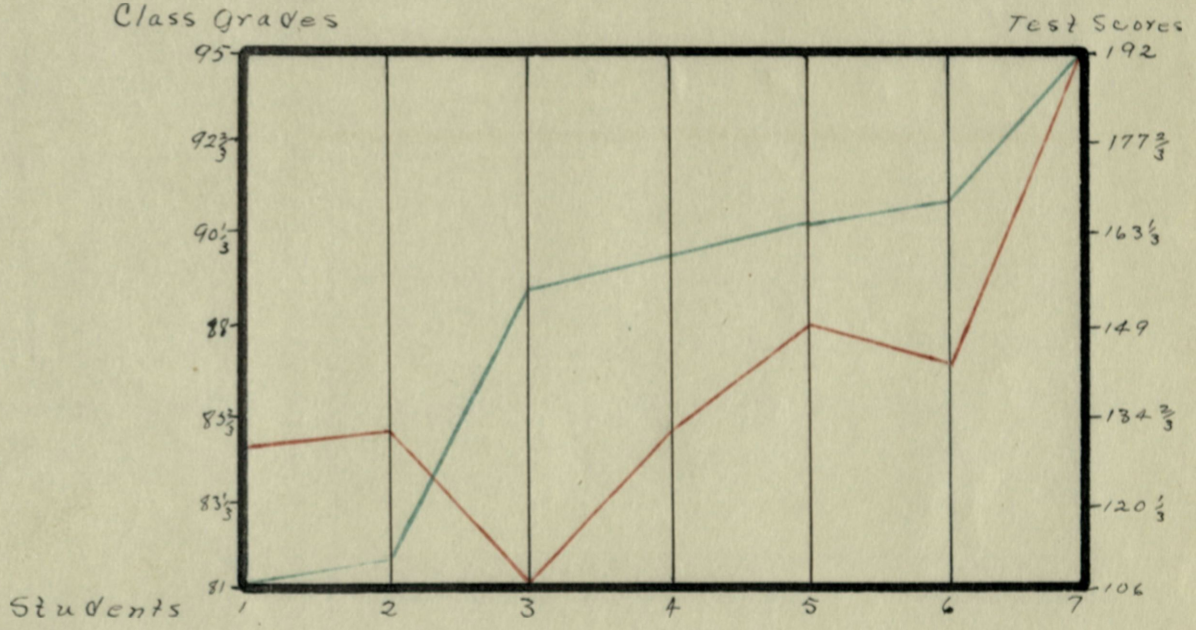


Graph XIV. High School Boys Group.

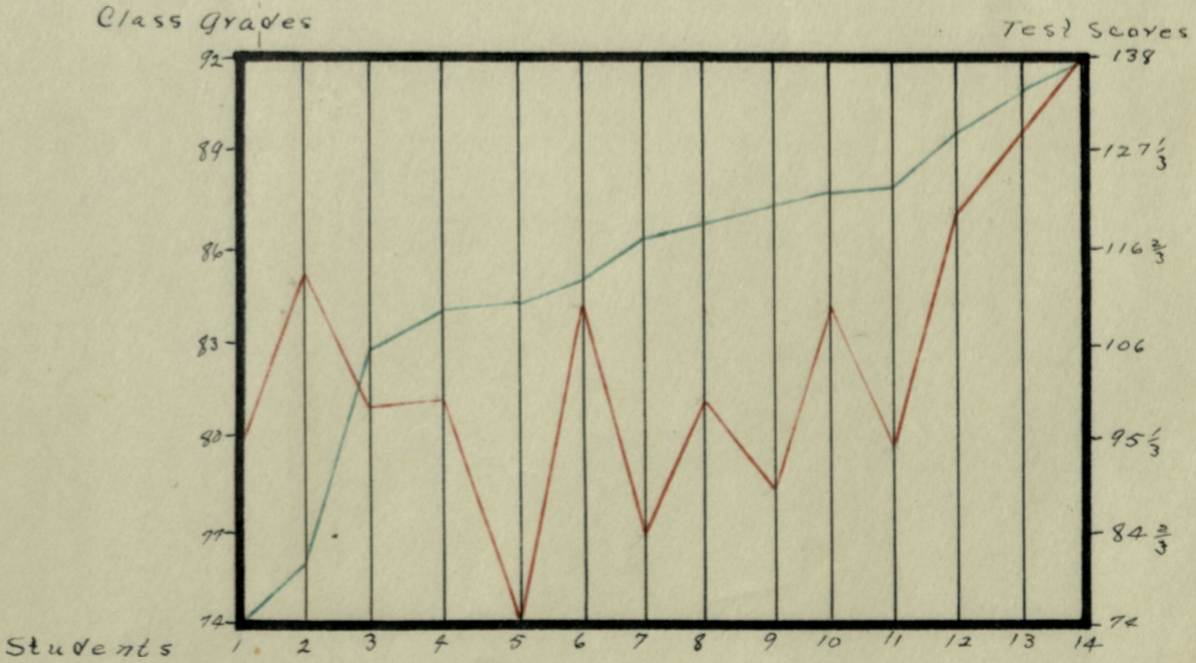


Graph XV. Senior Class Group.

The red line represents the test score, the green the school grade. The height at which they cut the vertical line indicates the grade and score made by each student in the group.

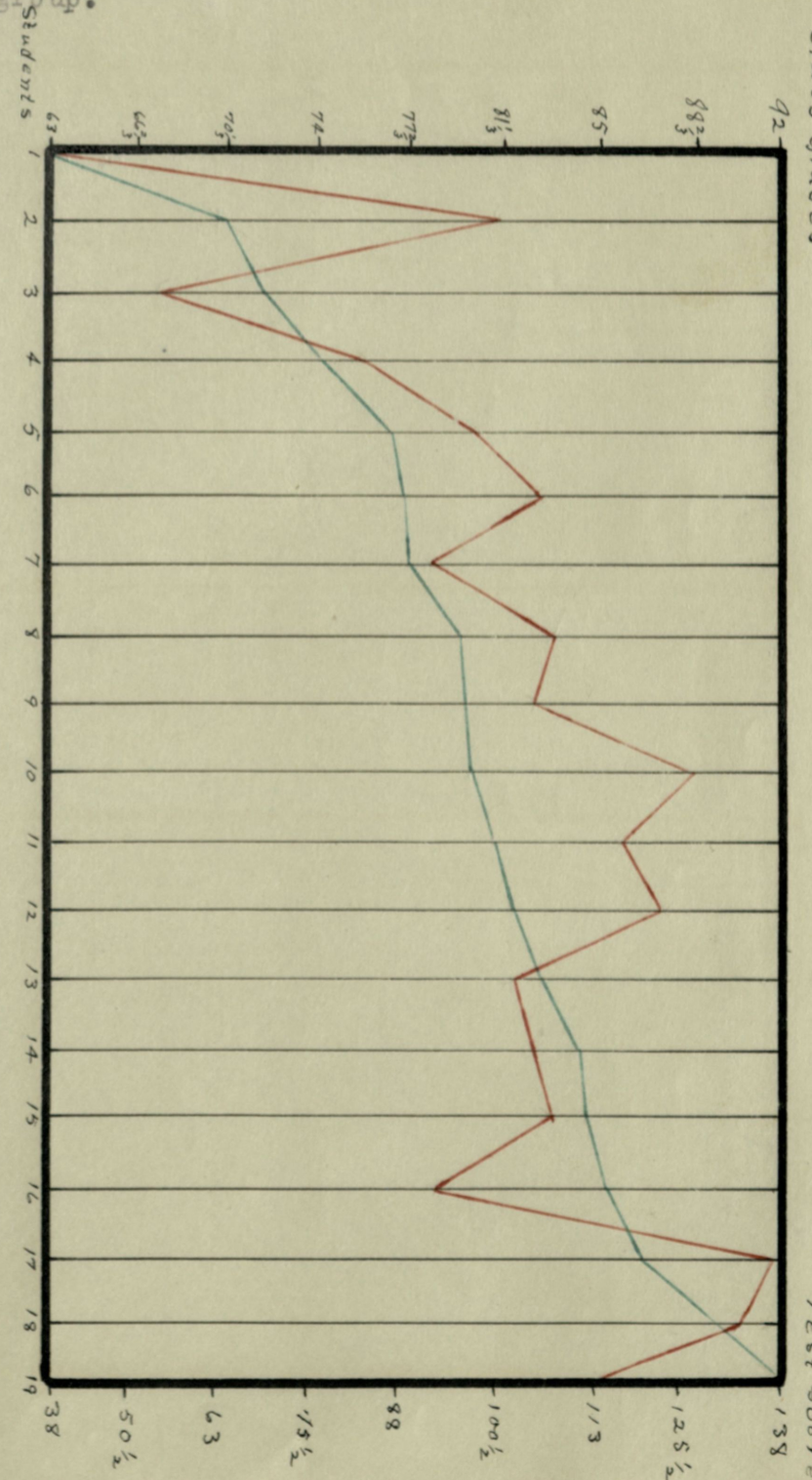


Graph XVI. Junior Class Group.



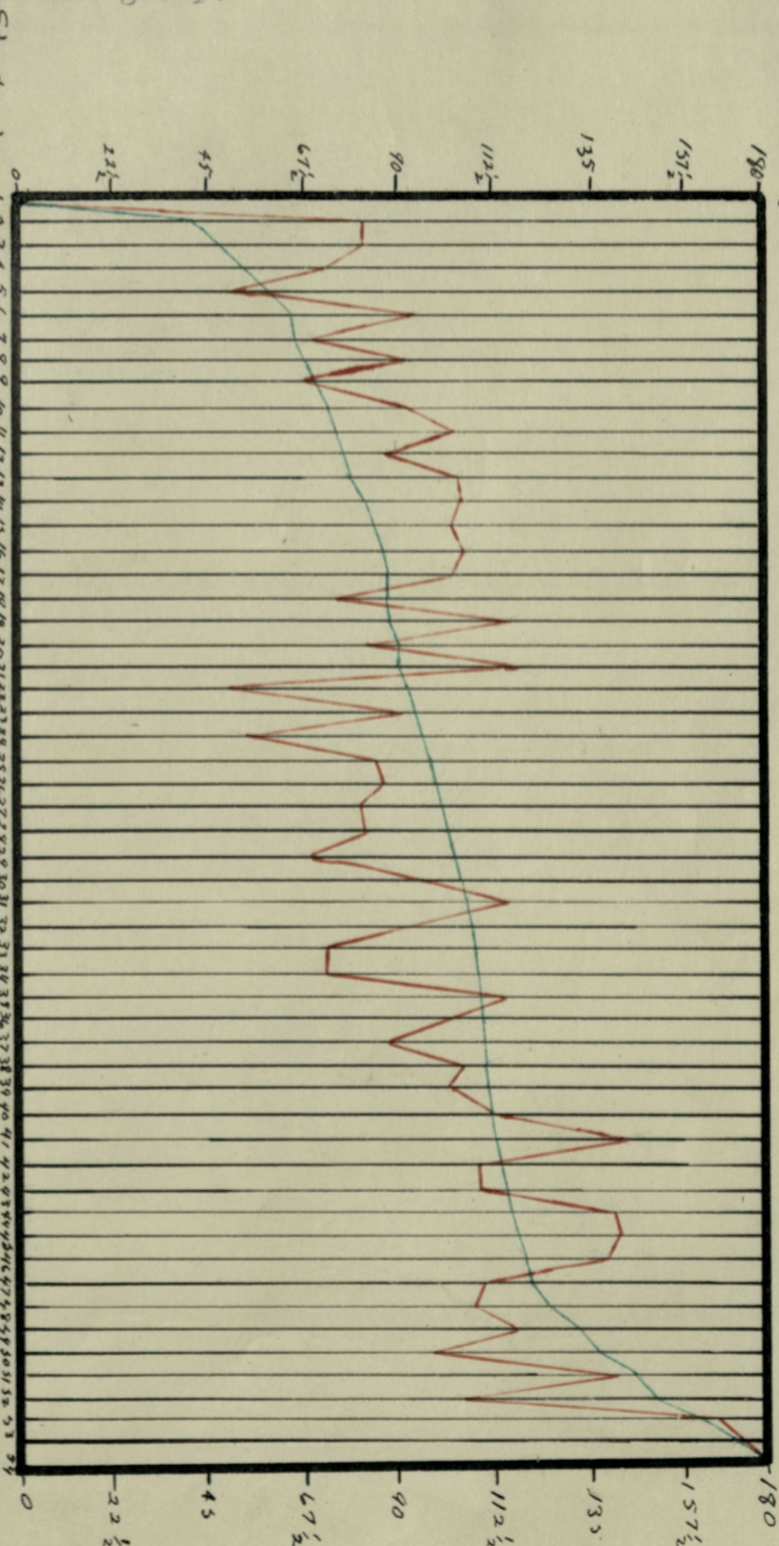
Graph XVII. Sophomore Class.

The red line represents the test score, the green the school grade. The height at which they cut the vertical line indicates the grade and score made by each student in the group.



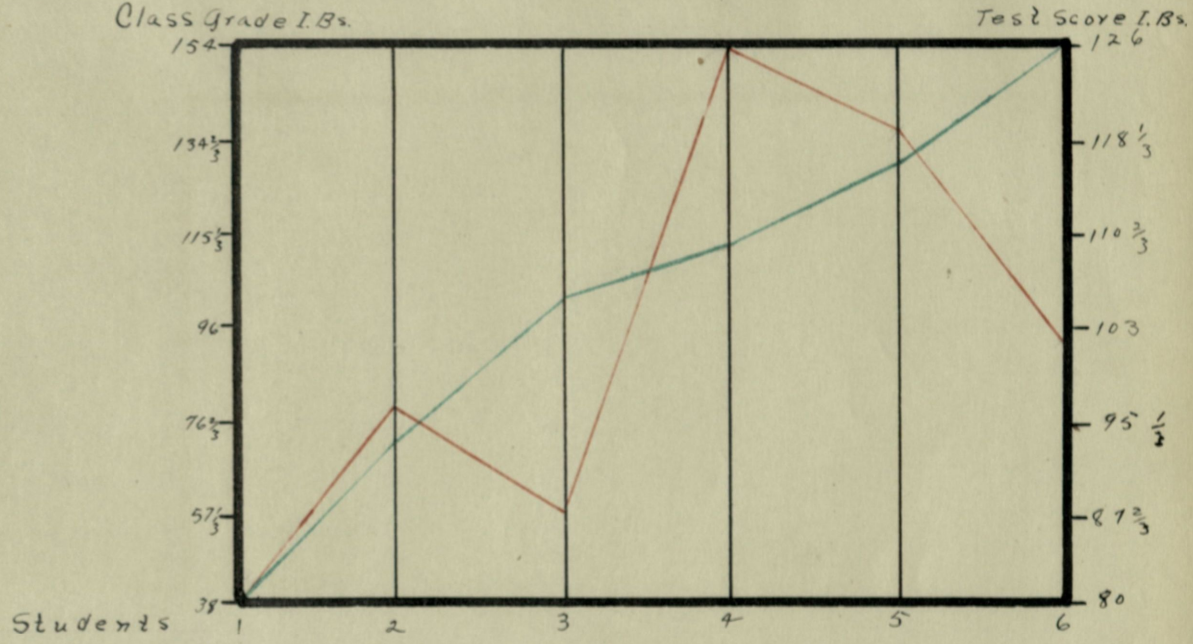
GRAPH XVIII. FRESHMAN CLASS GROUP.

The red line represents the test score I.B. the green the school grade I.B. The height at which they cut the vertical line indicates the grade I.B. and score I.B. made by each student in the group.

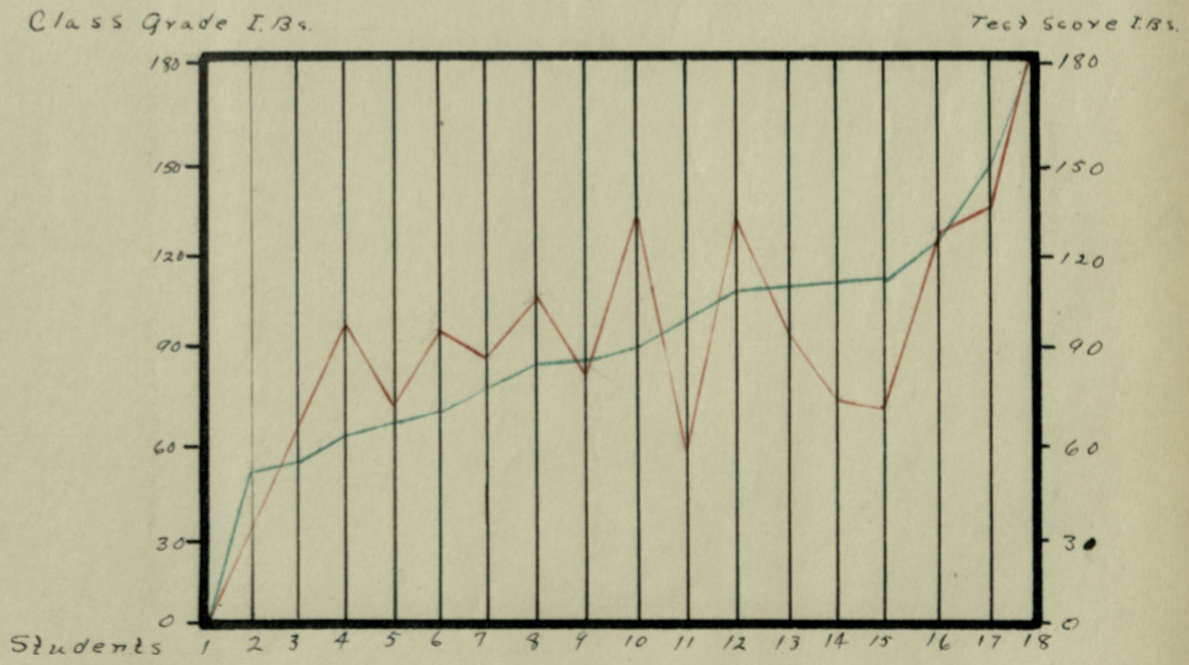


GRAPH XIX. ENTIRE HIGH SCHOOL GROUP

The red line represents the test score I.B. the green the school grade I.B. The height at which they cut the vertical line indicates the grade I.B. and score I.B made by each student in the group.

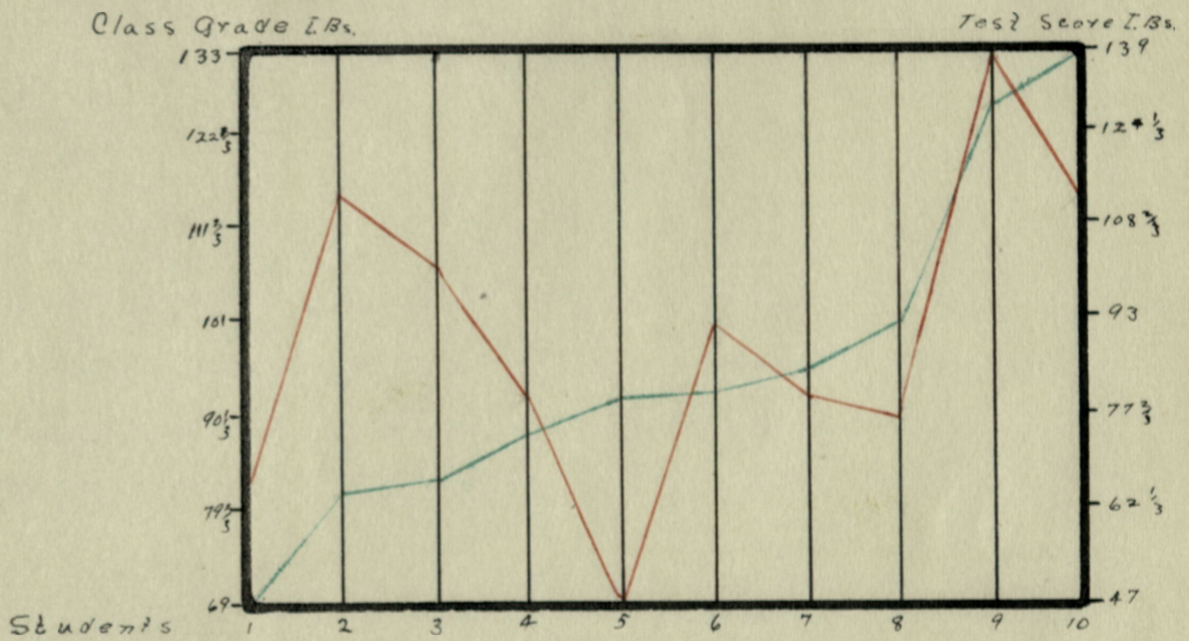


Graph XX. Age 14 Group.

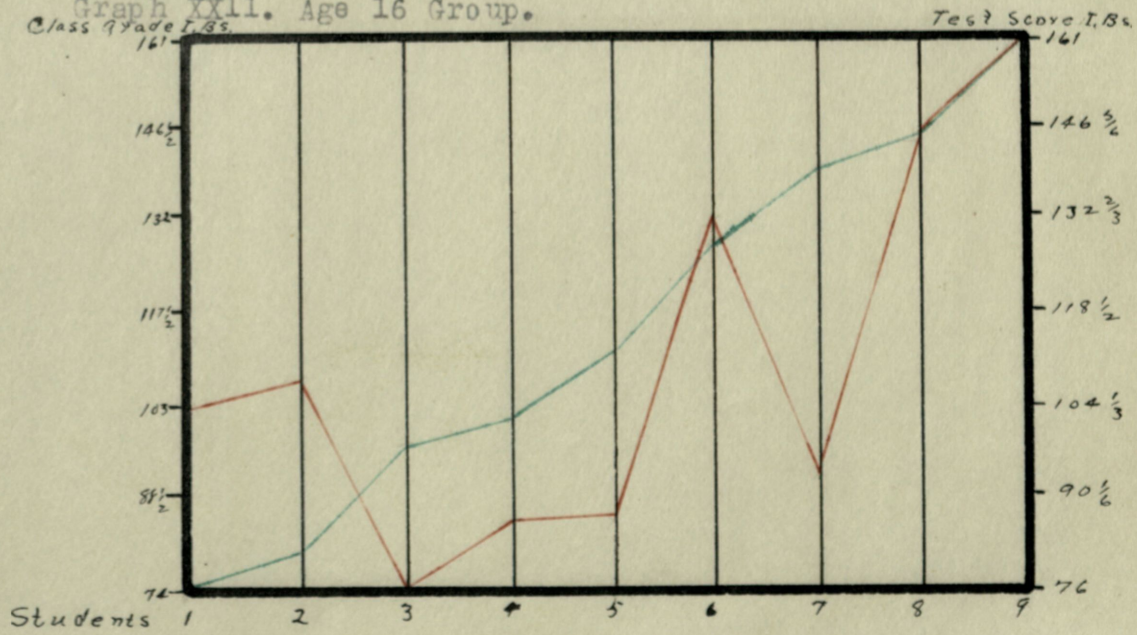


Graph XXI. Age 15 Group.

The red line represents the test score I.B. the green the school grade I.B. The height at which they cut the vertical line indicates the grade I.B. and score I.B. made by each student in the group.



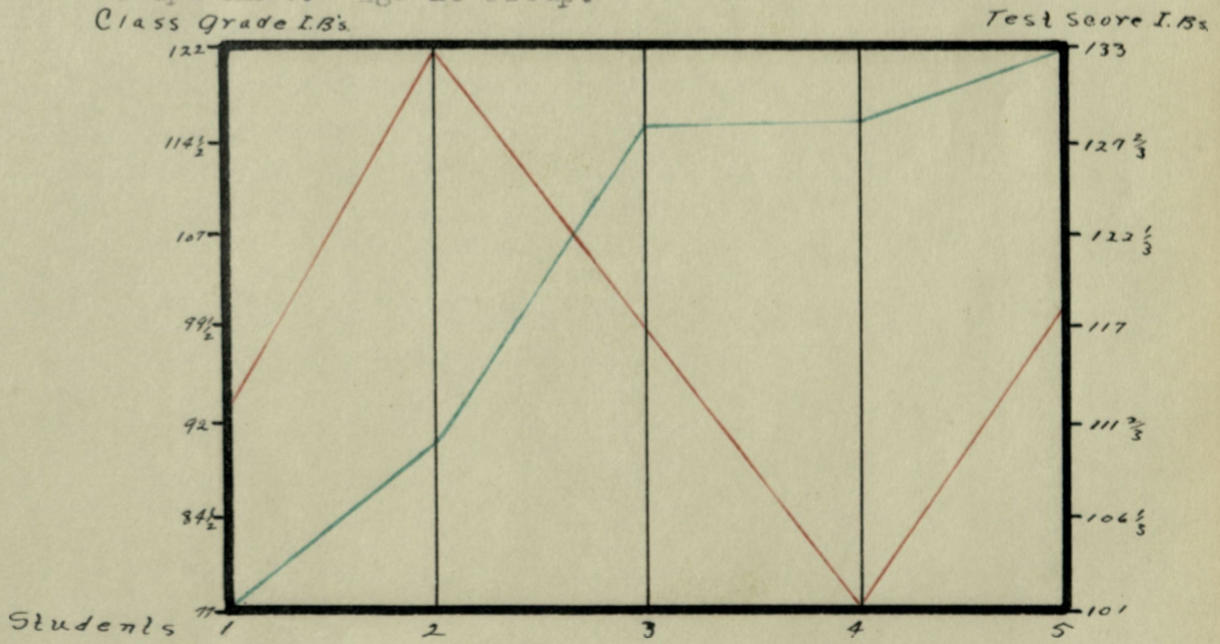
Graph XXII. Age 16 Group.



Graph XXIII. Age 17 Group.

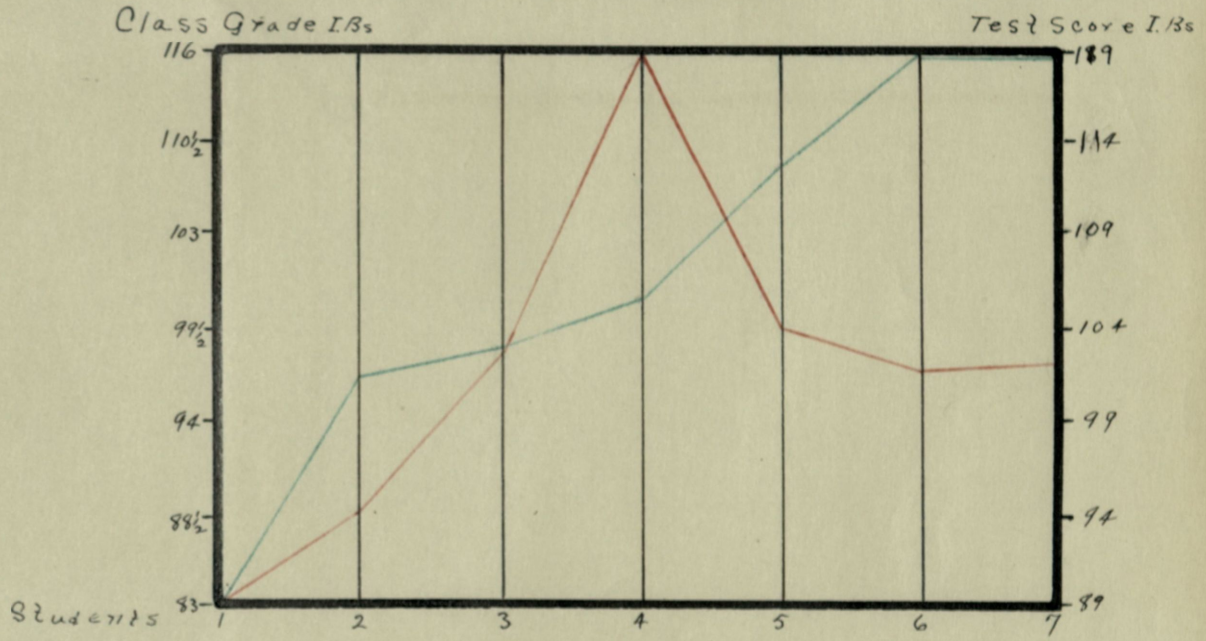
The red line represents the test score I.B. The green the school grade I.B. The height at which they cut the vertical line indicates the grade I.B. and score I.B. made by each student in the group.

Graph XXIV. Age 18 Group.

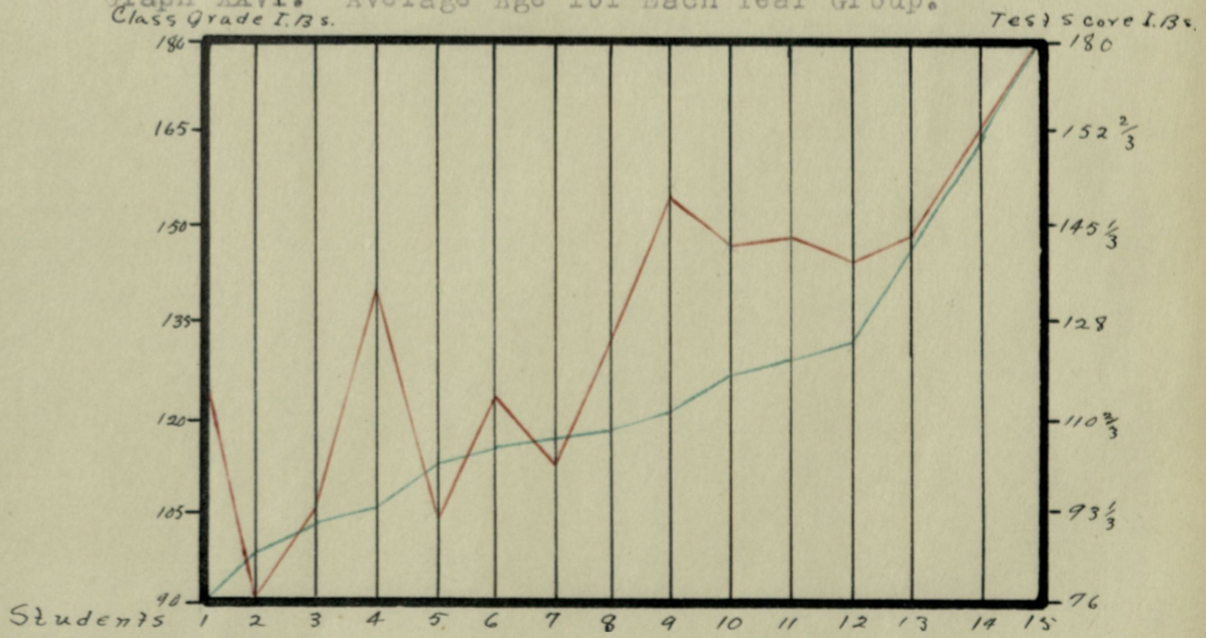


Graph XXV. Age 19 and 20 Group.

The red line represents the test score I.B. the green the school grade I.B. The height at which they cut the vertical line indicates the grade I.B. and score I.B. made by each student in the group.

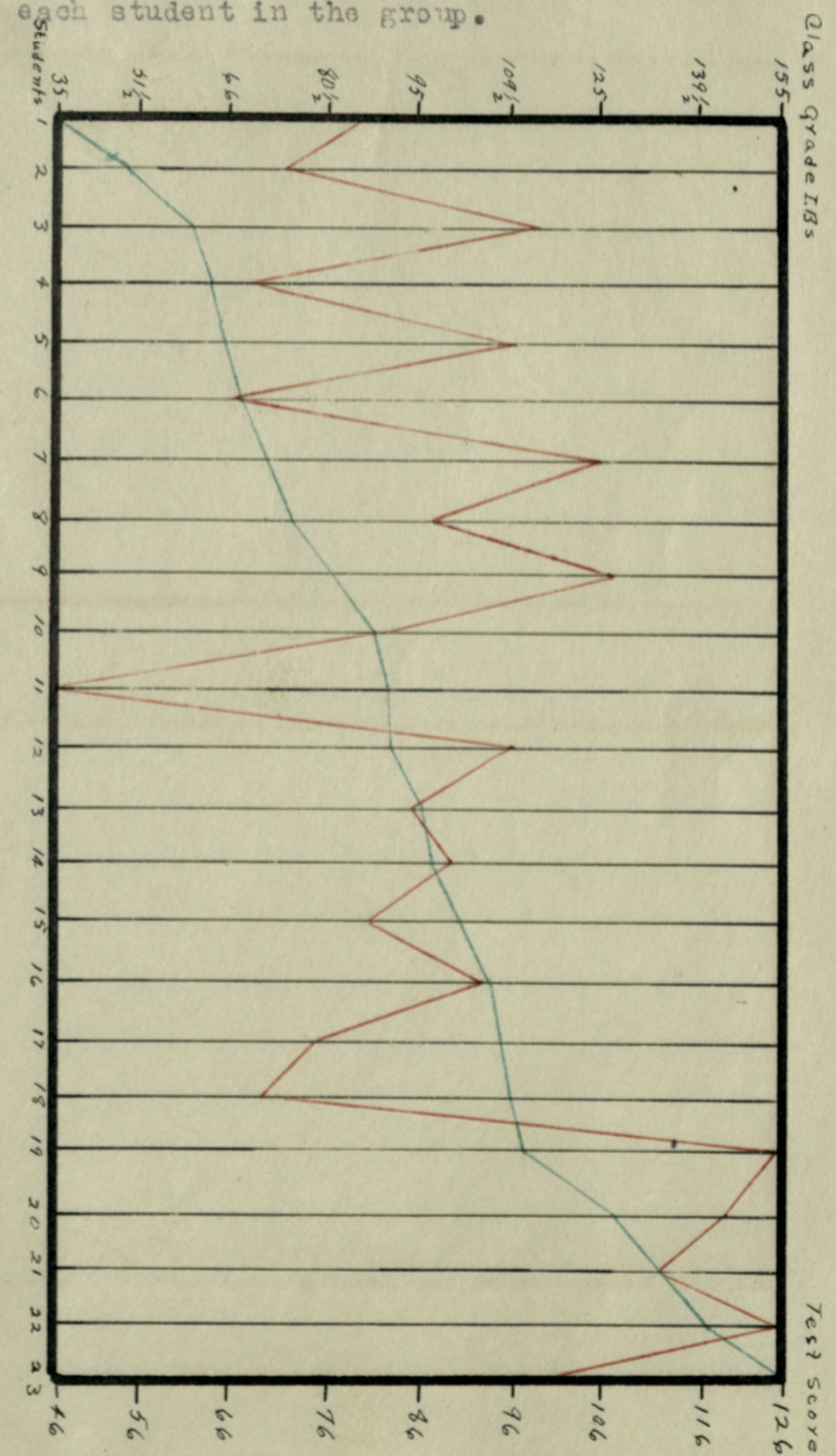


Graph XXVI. Average Age for Each Year Group.



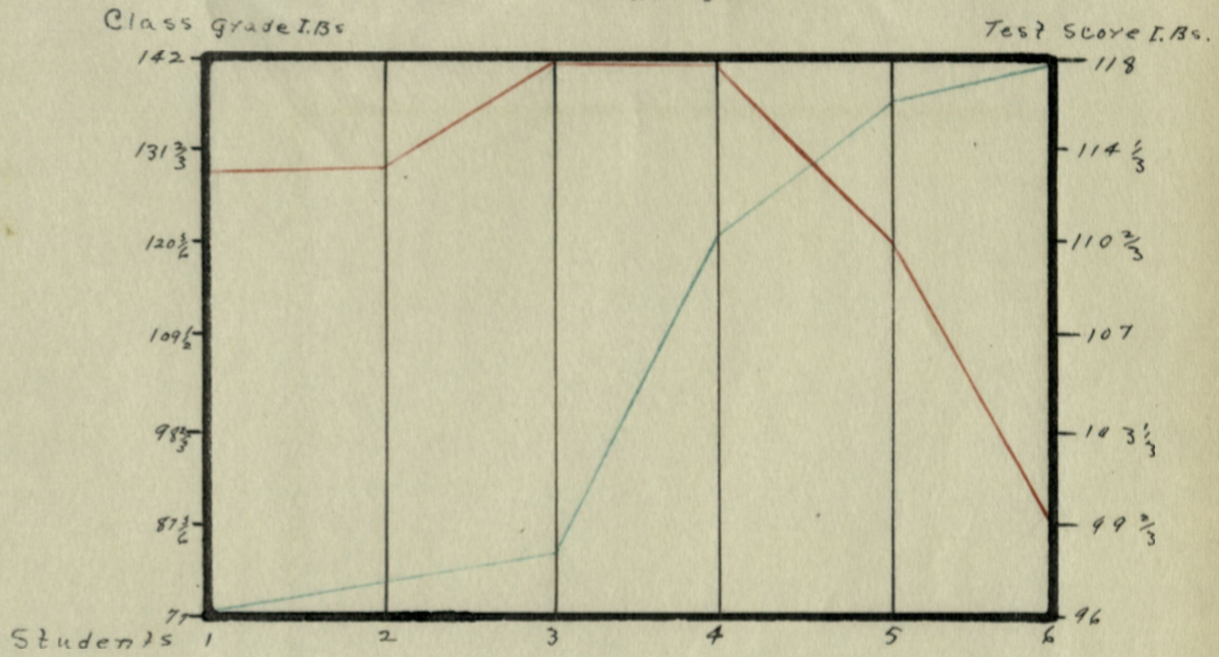
Graph XXVII. Junior and Senior Girls Group.

The red line represents the test score I.B. the green the school grade I.B. The height at which they cut the vertical line indicates the grade I.B. and score I.B. made by each student in the group.

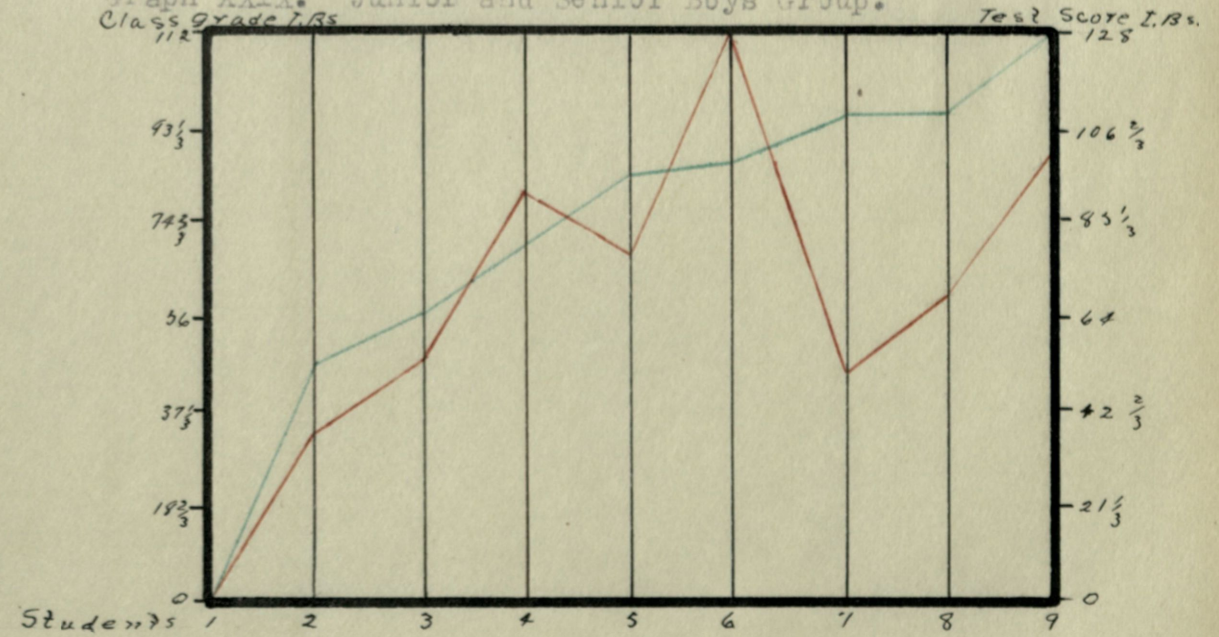


GRAPH XXVIII FRESHMAN-SOPHMORE GIRLS GROUP.

The red line represents the test score I.B. the green the school grade I.B. The height at which they cut the vertical line indicates the grade I.B. and score I.B. made by each student in the group.

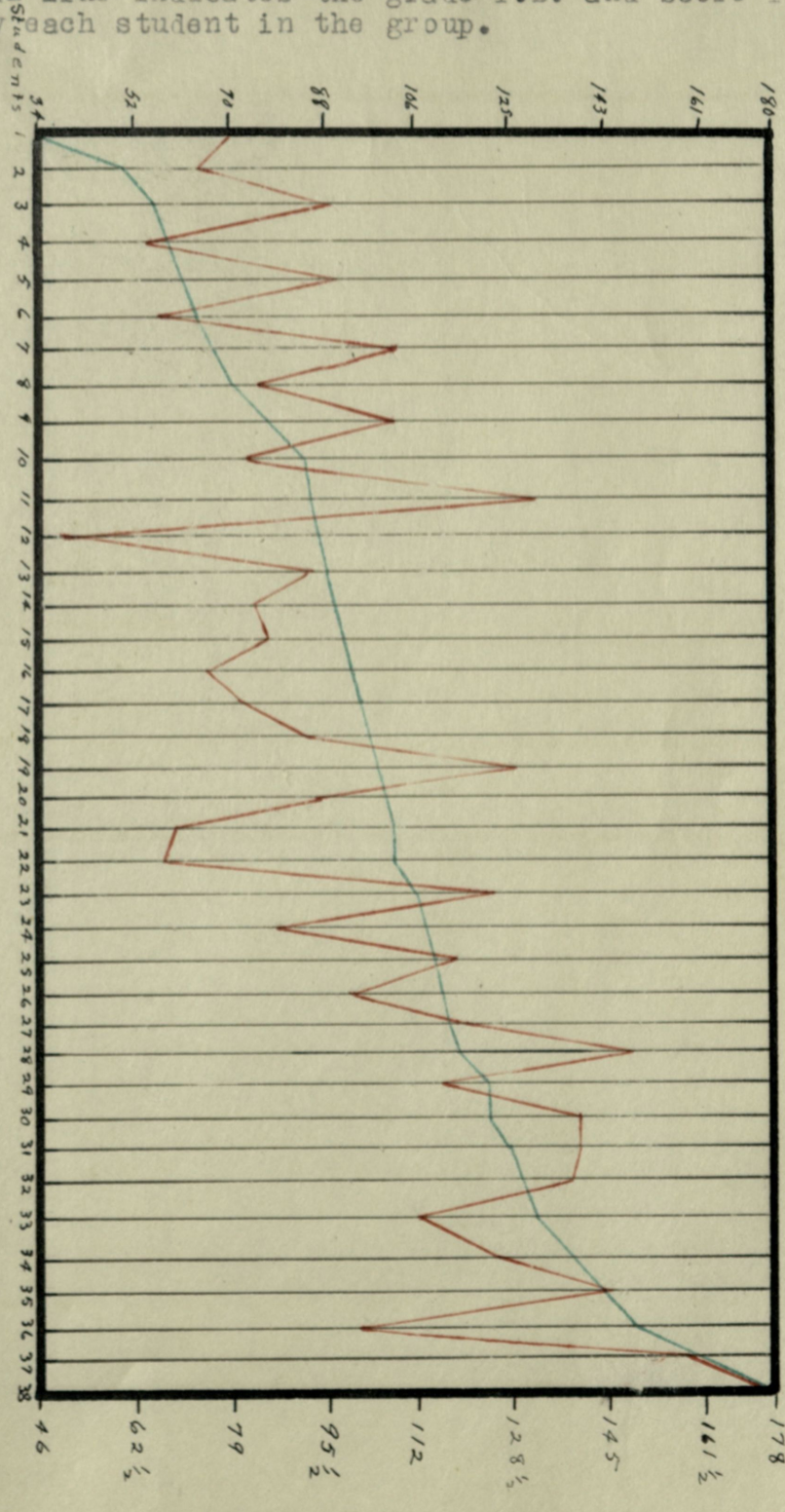


Graph XXIX. Junior and Senior Boys Group.



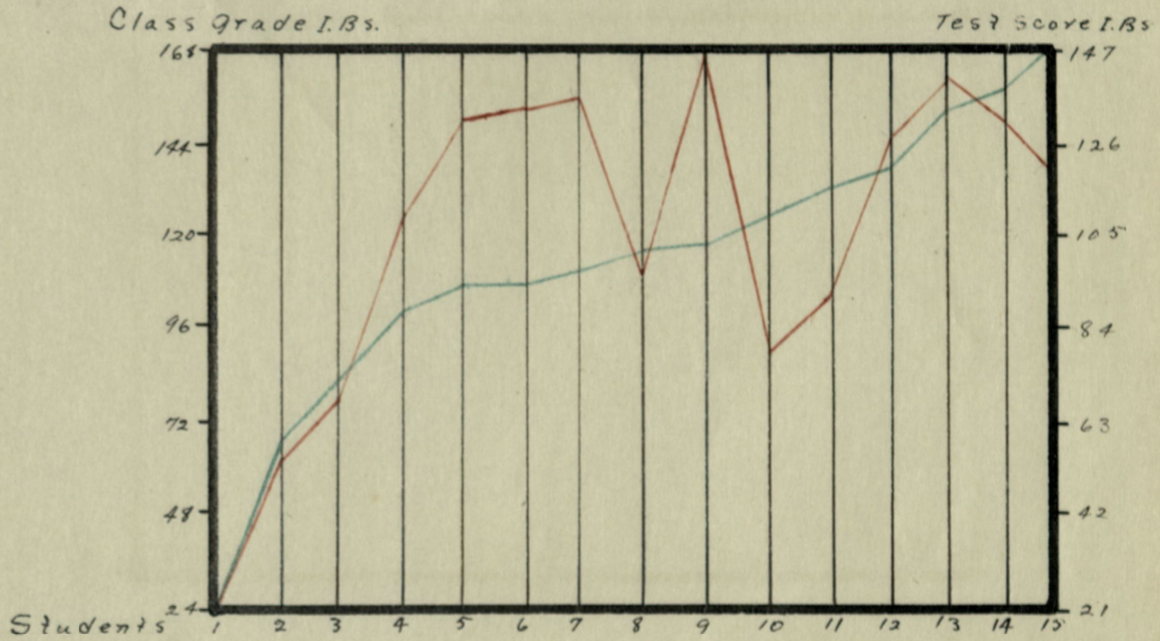
Graph XXX. Freshman and Sophomore Boys Group.

The red line represents the test score I.B The green the school grade I.B. The height at which they cut the vertical line indicates the grade I.B. and score I.B made by each student in the group.

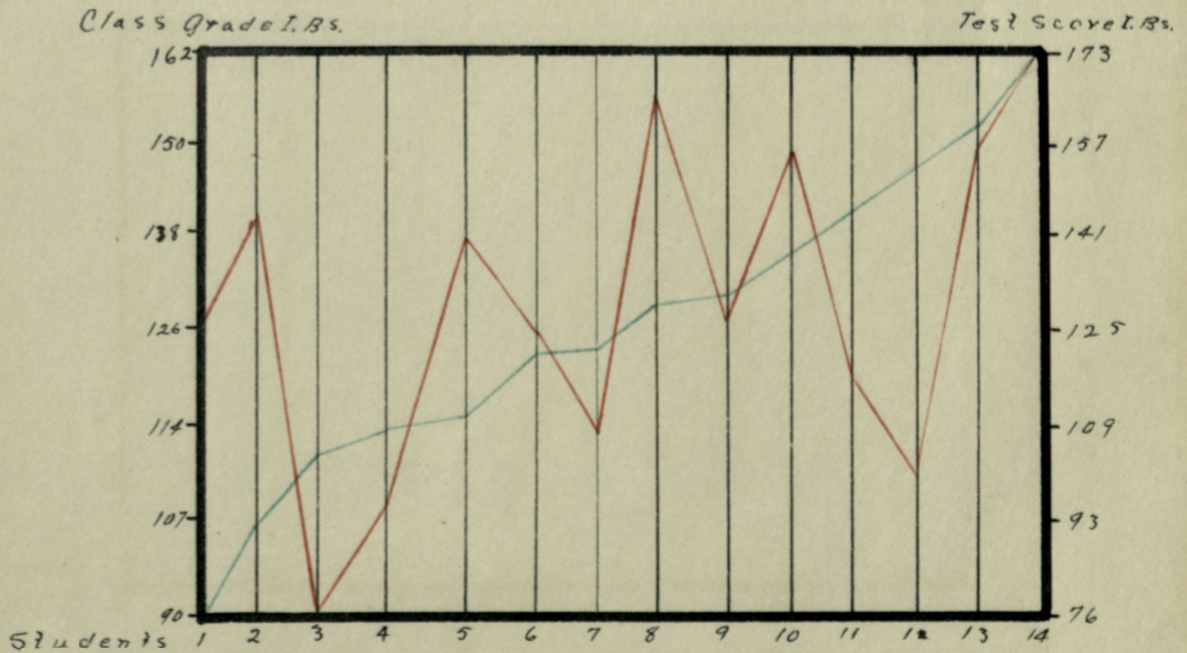


GRAPH XXXI. HIGH SCHOOL GIRLS GROUP.

The red line represents the test score I.B. the green the school grade I.B. The height at which they cut the vertical line indicates the grade I.B. and score I.B. made by each student in the group.



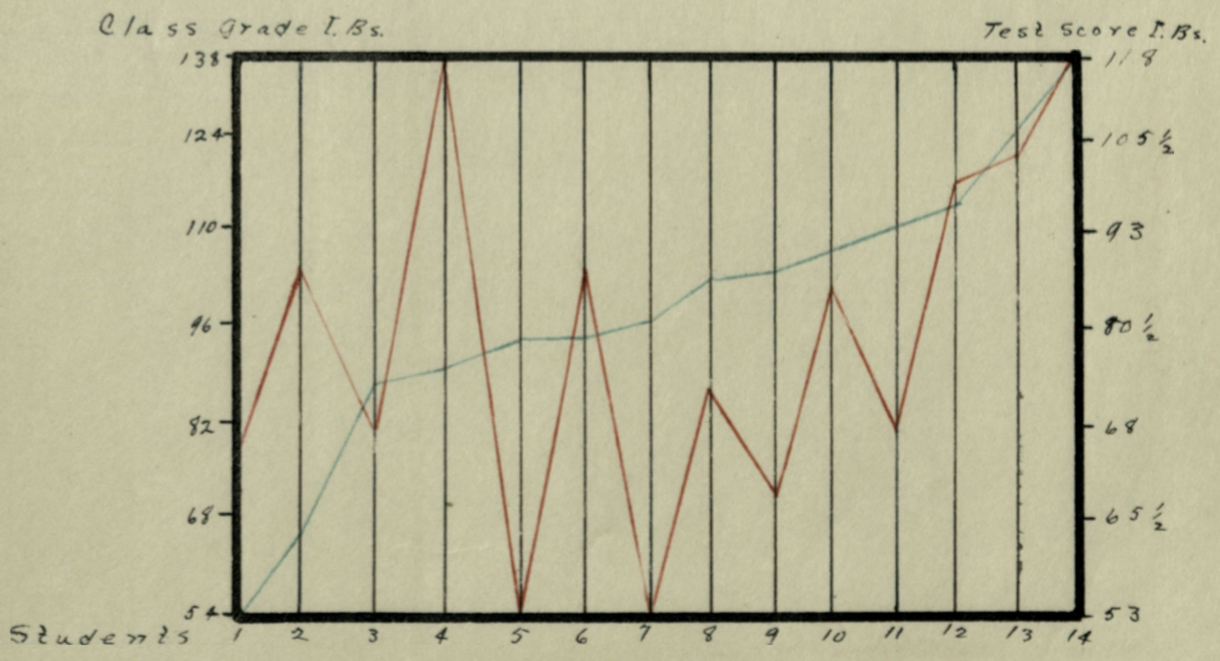
Graph XXXII. High School Boys Group.



Graph XXXIII. Senior Class Group.

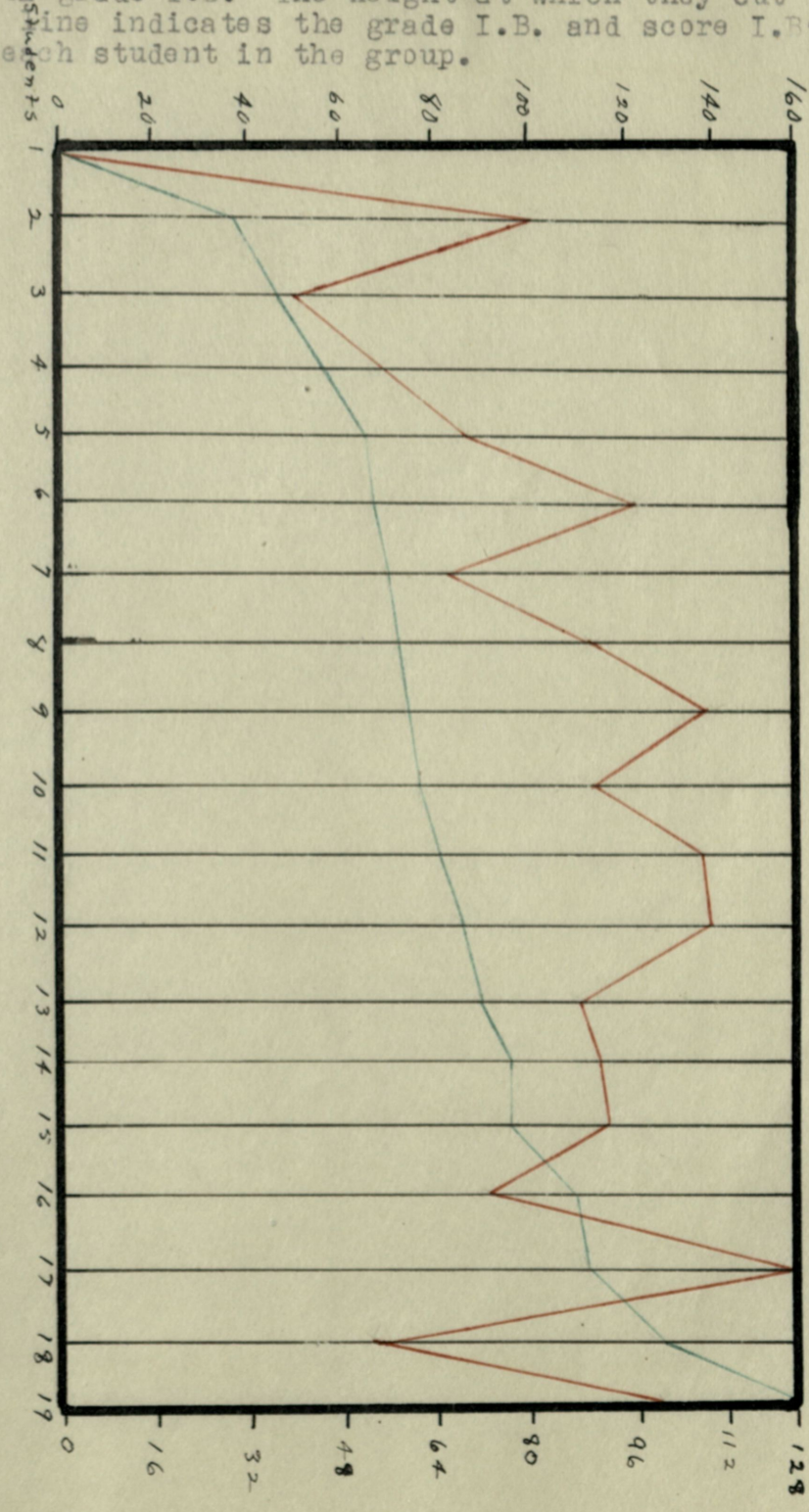
The red line represents the test score I.B. The green the school grade I.B. The height at which they cut the vertical line indicates the grade I.B. and score I.B. made by each student in the group.

Graph XXXIV. Junior Class Group.



Graph XXXV. Sophomore Class Group.

The red line represents the test score I.B. the green the school grade I.B. The height at which they cut the vertical line indicates the grade I.B. and score I.B. made by each student in the group.



GRAPH XXXVI. FRESHMAN CLASS GROUP.

Interpretation of Results

The coefficients of correlation found in the preceding tables range all the way from a negative correlation -.79 to a positive .903.

The Rugg standards for the coefficient of correlation are as follows,

r is negligible or indifferent if less then .15 or .20.

r is present but low if from .15-20 to .35 or .40.

r is markedly present or marked .35 or .40 to .50 or .60.

r is high above .60.

Another thing that should be taken into consideration at this point is the relative size of the probable error (P. E.). Referring again to Rugg, we find that statistical practice demands that the coefficient of correlation should be at least three times as large as the probable error. Since the probable error is a measure of the unreliability of the coefficient of correlation, it is desirable to have the probable error as small as possible in comparison to the coefficient of correlation. Again, since the unreliability increases as the number of cases involved decreases, it is also desirable to have as many

cases as possible. In studying the tables of the various school groups, we find that most of them show a very satisfactory ratio between the probable error and the coefficient of correlation even in the tables where the number of individuals involved is low. If we consider the entire high school we find that the coefficient of correlation is twelve times larger than the probable error which is a very good ratio, and shows that the coefficient of correlation obtained has a high degree of reliability.

Having this review of the significance of the magnitude of the probable error in mind we are now, I think, better prepared to consider the interpretation of the coefficients obtained from our tables and judge what degree of importance they may have. In considering the age groups, we find that all but the age 19 and 20 group have good correlations but there does not seem to be any logical increase or decrease from the extremes of the age groups. From the younger age groups to the older we find these correlations, .624, .569, .498, .676, -.362.

Looking at the 15 year old column, which has representation in each of the four school classes, we find that the score increases in size from the Freshman class to the Senior class showing that it takes a student of higher native mentality to become a Senior at 15 years.

Class	age 14 yrs.	age 15 yrs.	age 16 yrs.	age 17 yrs.	age 18 yrs.	age 19 yrs.	age 20 yrs.
Freshman	116 (1)	88 (1)	104 (1)	126 (1)	81 (1)		
Sophmore		109 (3)	103 (1)		105 (2)		
Junior		163 (2)	142 (2)	127 (3)			
Senior		141 (1)		127 (5)	147 (3)	134 (4)	113 (1)

Average score for each class for each year.

(The small numbers in the lower left hand corner of the squares indicate the number of individuals belonging to that age and class.)

Class	age 14 yrs.	age 15 yrs.	age 16 yrs.	age 17 yrs.	age 18 yrs.	age 19 yrs.	age 20 yrs.
Freshman	84 (6)	78 (7)	82 (4)	81 (1)	74 (1)		
Sophmore		83 (3)	86 (4)		87 (2)		
Junior		92 (2)	86 (2)	87 (3)			
Senior		86 (1)		90 (5)	91 (3)	86 (4)	89 (1)

Average grade for each class for each year.

(The small numbers in the lower left hand corner of the squares indicate the number of individuals belonging to that age and group).

by the time he has reached 15 than it does to become a freshman at that age.

Similar results were found by J. N. Madsen in a study of the scores obtained from the tests given to the students of the Madison, Rockford and Sioux City Schools. The results of that study were even more regular than in this study due to the larger number of individuals involved. I believe the discussion above will also explain the cause of the poor correlation found in the 19 and 20 year group.

In comparing the correlations made by the different group of girls and the corresponding group of boys we find that with one exception the girls have secured a higher coefficient than the boys. Taking the entire high school the girls have a coefficient of correlation of .739 ± .049 as compared with .687 ± .089 for the boys. Combining the Freshman and Sophomore classes the girls have a coefficient of correlation of .506 ± .104 as compared with .763 ± .093 for the boys. The Junior and Senior girls have a coefficient of correlation of .451 ± .013 while the boys have a negative coefficient of -.496 ± .203. Probably one reason for the higher

(I) School and Society 11:298 - 300 Mr. 6'20.

coefficient secured by the girls is that in every case a larger number of individuals is found in the girls group, the ratio being more than two to one.

The poor coefficient secured by the Junior and Senior boys may be accounted for by a study of their individual school grade rank and test score rank which shows in most cases a great divergence. Part of this is probably due to the lack of application to school work on the part of some individuals and the close application on the part of others. The lack of application would throw the individual's school grade rank down farther than it ought to be, while a close application to school work would tend to raise the rank. In either case the coefficient would be poor.

To illustrate this by an actual example, we find that a Senior boy ranked 42 in the school grades while he secured the 18th place in the score rank. In the class room this student showed that he had the ability to do a pretty good grade of work when he chose to do so but it was difficult for him to hold himself to close application over a very extended period. The results were he barely made his grades. Another Senior boy ranked 7th in the school grades while he fell down to 21 in the score rank. This student gave close application to his school work and made excellent grades.

In considering the different school classes we find that the Freshman and Sophomore classes have higher coefficients than either the Junior or Senior classes. I find no satisfactory explanation to account for this difference. It certainly cannot be due to the number of individuals for the Sophomore class which has 14 members and made a coefficient of correlation of .870 ± .043 as compared with a coefficient of correlation of .469 ± .140 made by the Senior class which had the same number of students. I am inclined to think the difference is due simply to the individual class characteristics the same as any four persons may show a difference in their individual characteristics. Taking the entire 18 class groups we find that all but two of the groups have a positive coefficient and of these nine would be considered high by Rugg and seven marked.

A separate interpretation of the I.B. groups will not be given, for those groups include the same high school groups as the others do and about the same general results were obtained.

CONCLUSION

In summary, the results of this investigation would seem to justify the following conclusions in an attempt to answer the question stated earlier in this thesis as to what relation exists between a student's intelligence score and the class grades he earns in school.

1. If a student makes a high test score, (Using the Otis group Intelligence Tests) we can expect him to do good work in school.
2. If a student makes a low test score, we cannot expect him to excel in his school work.
3. Although intelligence tests are not yet perfect, still their reliability is great enough to make them very valuable for measuring a student's ability.
4. Intelligence tests may be used to make better adjustments between the student and his class work.
5. Intelligence tests may be used to secure a better classification for students.
6. Intelligence tests may be a help in advising students as to the general nature of the work they should follow.

It might also be well to note here that in giving intelligence tests, care must be used to prevent unnatural conditions from modifying the results of the tests.

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Inclosure ofBlanks.

Only two inclosures of blanks are included in this thesis. One a copy of the Otis Tests, which is included because the Otis Tests were the ones used in securing the data.

The other blank is a copy of the Army Tests, and is included because of the frequency the army tests are referred to in the thesis and also because of the prominent place the Army tests have taken all over the country.

OTIS GROUP INTELLIGENCE SCALE

Devised by ARTHUR S. OTIS

Edition: 1919

Form A

EXAMINATION BOOKLET

Examination Number..... Name.....
(First name, initial, and last name)

Age last birthday.....years. Birthday.....
(Tell in figures) (Month, day)

School..... Grade.....

City..... Date.....19....
(Month, day, year)

(Do not write below this line.)

Remarks or Further Data

1 .....

2 .....

3 .....

4 .....

5 .....

6 .....

7 .....

8 .....

9 .....

10 .....

11 .....

12 .....

13 .....

14 .....

15 .....

TEST	SCORE
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
Total Score	
MA	
IQ	
PR	
CB	

OGIS: A–2

TEST 1

Following Directions

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

Sample problem: Write the fifth letter of the alphabet.....(E)

Begin here:

1. Do you understand that each letter is to be a capital made like printing and put in the parenthesis after the problem? If so, write C in the parenthesis.....( ) 1
2. Will you remember not to ask any questions during the examination? If so, write Q.....( ) 2
3. Will you remember not to look toward the paper of any other pupil during the examination? If so, write L.....( ) 3
4. Will you remember not to turn over your booklet or any page of it at any time unless you are told to? If so, write B; if not, write N.....( ) 4
5. Write the letter O.....( ) 5
6. Write the eighth letter of the alphabet.....( ) 6
7. Write the same letter that you were told to write in the fifth problem.....( ) 7
8. Write the letter which follows the third letter of the alphabet.....( ) 8
9. Write the letter which the letter L follows in the alphabet.....( ) 9
10. If K comes after R in the alphabet, write K; if not, write R.....( ) 10
11. Suppose all the even numbered letters in the alphabet (that is, the 2d, 4th, 6th, etc.) were crossed out. The fifth letter left, not crossed out, would be what letter?( ) 11
12. Write the letter which follows the letter which comes next after B in the alphabet.( ) 12
13. If E and F appear together in the alphabet, write E, unless T and Z also appear together in the alphabet, in which case write T instead.....( ) 13
14. Write the letter which is the third letter to the right of the letter which is midway between K and O.....( ) 14
15. Suppose that the first and second letters of the alphabet were interchanged, also the third and fourth, the fifth and sixth, etc. Write the letter which would then be the 14th letter in the alphabet.....( ) 15
16. A certain letter is the second letter to the left of another letter. This second letter is the fifth letter to the right of Q. What is the "certain letter" first mentioned?..( ) 16
17. A certain letter is the fourth letter to the right of another letter. This other letter is midway between two other letters. One of these last two letters is next after E in the alphabet and the other is just before K in the alphabet. What is the "certain letter" first mentioned?.....( ) 17
18. If the letters in the word IF appear in the same order that they do in the alphabet and if the same is true of the letters in the word AN, write the letter Z. But if this is true of only one of these words, write the last letter of that word.....( ) 18
19. Find the letter which, in this sentence, appears a second time nearest the beginning. Write it, using a capital.....( ) 19
20. Find the two letters in the word AFTER which have just as many letters between them in the alphabet as in the word. Write the one of these two letters that comes first in the alphabet.....( ) 20

Score.....

TEST 2

Opposites

Samples: up.....(short, down, small, low, young)
hot.....(warm, ice, dark, cold, fire)

DIRECTIONS. Look at the first word on each line, think what word means exactly the opposite of it, find that word among the five words in parenthesis on that line and draw a line under it.

Begin here:

1. east.....(north, west, south, pole, equator)..... 1
2. yes.....(may-be, wrong, no, sure, nothing)..... 2
3. top.....(bottom, side, cover, inside, feet)..... 3
4. before.....(late, now, soon, when, after)..... 4
5. difficult.....(hard, quick, soft, easy, common)..... 5
6. friend.....(brother, acquaintance, enemy, wife, stranger).... 6
7. succeed.....(win, decline, fail, accede, try)..... 7
8. command.....(officer, shout, order, obey, soldier)..... 8
9. beautiful.....(crooked, handsome, old, ugly, dirty)..... 9
10. brave.....(painful, fear, weak, stingy, cowardly)..... 10
11. pride.....(sorrow, humility, miserable, conceit, proud)..... 11
12. expand.....(burst, smaller, contract, vanish, stay)..... 12
13. genuine.....(coarse, counterfeit, adulterated, worthless, impure) 13
14. help.....(person, work, push, give, hinder)..... 14
15. love.....(like, anger, hate, strange, lover)..... 15
16. graceful.....(rough, homely, miserable, awkward, stout)..... 16
17. extravagant....(miser, humble, economical, poor, wasteful)..... 17
18. cause.....(reason, because, origin, effect, why)..... 18
19. abolish.....(alter, create, continue, destroy, change)..... 19
20. loyal.....(treacherous, enemy, thief, coward, jealous)..... 20
21. always.....(sometimes, often, occasionally, seldom, never).... 21
22. fickle.....(silly, constant, stationary, solid, sober)..... 22
23. therefore.....(since, why, may-be, there, cause)..... 23
24. however.....(nevertheless, moreover, whether, even, never).... 24
25. unless.....(and, therefore, however, also, if)..... 25

Score.....

TEST 3

Disarranged Sentences

Samples:
- men money for work. ..... (true false)
- uphill rivers flow all. ..... (true false)
- ocean waves the has. ..... (true false)

DIRECTIONS. The words on each line below make one sentence if put in order. If the sentence the words would make is *true*, underline the word *true* at the side of the page. If the sentence they would make is *false*, underline the word *false*.

Begin here:

1. eat grass cows ..... (true false) 1
2. sail ocean ships the on ..... (true false) 2
3. sun morning the the in sets ..... (true false) 3
4. trees birds nests the in build ..... (true false) 4
5. mountains live the in whales ..... (true false) 5
6. comes Christmas a but year once ..... (true false) 6
7. float iron water on will ..... (true false) 7
8. days there in are week seven a ..... (true false) 8
9. usually are of made tables wood ..... (true false) 9
10. has short very a a neck giraffe ..... (true false) 10
11. cream ice children like most ..... (true false) 11
12. milk bees flowers gather the from ..... (true false) 12
13. obtained sea sugar from is water ..... (true false) 13
14. fuel wood are coal and for burned ..... (true false) 14
15. substances light lead gold and are very ..... (true false) 15
16. rivers lakes and many desert has a ..... (true false) 16
17. moon earth the from feet twenty the is ..... (true false) 17
18. hump camel has a his a back on ..... (true false) 18
19. grow and apples ground oranges the in ..... (true false) 19
20. music fond people many are of ..... (true false) 20
21. and eat good gold silver to are ..... (true false) 21
22. clouds rain sky from comes the the in ..... (true false) 22
23. mile a a a travel snail in can minute ..... (true false) 23
24. automobile pocket man his keeps a his in ..... (true false) 24
25. vote persons twenty-one cannot under ..... (true false) 25

Right..... *Wrong*..... *Score*.....

TEST 4

Proverbs

DIRECTIONS. Read each proverb, find the statement that explains it, and put the number of that statement in the parenthesis before the proverb.

Proverbs (Group 1)

( ) Make hay while the sun shines.
( ) A drowning man will grasp at straws.
( ) A stitch in time saves nine.
( ) Rats desert a sinking ship.
( ) In a calm sea every man is a pilot.
( ) Destroy the lion while it is young.
( ) He who would eat the kernel must crack the nut.
( ) One swallow does not make a summer.
( ) People who live in glass houses must not throw stones.
( ) A mouse must not think to cast a shadow like an elephant.

Statements to Explain Proverbs in Group 1

1. It pays to attend to troubles before they get worse.
2. Leadership is easy when all goes well.
3. Make the best of your opportunities.
4. Those who would reap rewards must work for them.
5. It pays to do only one thing at a time.
6. Desperate people cling to absurd hopes.
7. False friends flee from us in disaster.
8. Weed out bad habits before they are too firmly established.
9. It is best to be silent when there is nothing to say.
10. Those who have faults should not criticize others.
11. Do not attempt the impossible.
12. A single sign is not convincing.

Proverbs (Group 2)

( ) Every rose has its thorn.
( ) A tree is known by its fruits.
( ) All is not gold that glitters.
( ) Where there is much smoke there must be some fire.
( ) No wind can do him good who steers for no port.
( ) Plant the crab tree where you will, it will not bear sweet apples.
( ) A bird in the hand is worth two in the bush.
( ) Too many cooks spoil the broth.
( ) Meddle not with dirt — some of it will stick to you.
( ) It is a long road that has no turn.

Statements to Explain Proverbs in Group 2

1. Environment will not change one's nature.
2. There is no happiness without its pain or sorrow.
3. Appearances are often deceptive.
4. It is better to be content with little than to gamble for more.
5. One cannot have the same luck forever.
6. No object can be attained without some sacrifice.
7. Deeds show the man.
8. We cannot help those who have no object in life.
9. Suspicions usually have some basis.
10. Association with evil is sure to leave its effect.
11. Who undertakes too much accomplishes little.
12. Division of responsibility brings poor results.

Score.....

TEST 5

Arithmetic

DIRECTIONS. Place the answer to each problem in the parenthesis after the problem. Do any figuring you wish on the margin of the page.

1. If a boy had 10 cents and earned 5 cents, how much money did he have then? ( ) cents 1
2. At 4 cents each, how much will 12 pencils cost? ( ) cents 2
3. If a man had $25 and spent $10, how much money did he have left? ( ) dollars 3
4. At 6 cents each, how many pencils can be bought for 48 cents? ( ) pencils 4
5. A boy spent 20 cents and then earned 30 cents. How much more money did he have than at first? ( ) cents 5
6. How far can a train go in 5 hours at the rate of 40 miles per hour? ( ) miles 6
7. How long will it take a glacier to move 1000 feet at the rate of 100 feet a year? ( ) years 7
8. If $2\frac{1}{2}$ yards of cloth cost 20 cents, what will 10 yards cost? ( ) cents 8
9. If 2 pencils cost 5 cents, how many pencils can be bought for 50 cents? ( ) pencils 9
10. If a man walks east from his home 7 blocks and then walks west 4 blocks, how far is he from his home? ( ) blocks 10
11. If a boy can run at the rate of 5 feet in $\frac{1}{8}$ of a second, how far can he run in 10 seconds? ( ) feet 11
12. A ship has provisions enough to last a crew of 20 men 50 days. How long would they last a crew of 40 men? ( ) days 12
13. One schoolroom has 7 rows of seats with 8 seats in each row, and another schoolroom has 6 rows of seats with 9 seats in each row. How many more seats does one room have than the other? ( ) seats 13
14. If 10 boxes full of oranges weigh 500 pounds, and each box when empty weighs 5 pounds, what do all the oranges weigh? ( ) pounds 14
15. Town X is 30 miles north of Town Y. Town Y is 15 miles north of Town Z. How far is Town Z from Town X? ( ) miles 15
16. If $3\frac{1}{2}$ yards of cloth cost 70 cents, what will $2\frac{1}{2}$ yards cost? ( ) cents 16
17. If a strip of cloth 36 inches long will shrink to 33 inches when washed, how long will a 48-inch strip be after shrinking? ( ) inches 17
18. If Frank can ride a bicycle 300 feet while George runs 200 feet, how far can Frank ride while George runs 300 feet? ( ) feet 18
19. A hotel serves a mixture of 3 parts cream and 2 parts milk. How many pints of cream will it take to make 25 pints of the mixture? ( ) pints 19
20. If a wire 20 inches long is to be cut so that one piece is $\frac{2}{3}$ as long as the other piece, how long must the longest piece be? ( ) inches 20

Score.....

TEST 6

Geometric Figures

DIRECTIONS. Each problem asks a question that is answered by a number. Write the answer to each problem in the parenthesis after the statement of the problem.

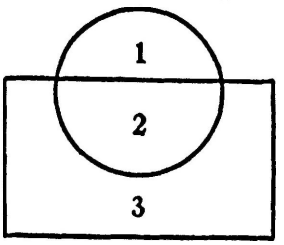


Fig. I

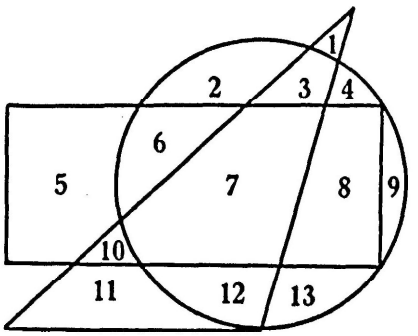


Fig. II

Sample problem:

Look at Fig. I. What number is in the circle but not in the rectangle?.....(1)

1. What number in Fig. I is in the rectangle but not in the circle?.....( ) 1
2. What number in Fig. I is in both the rectangle and the circle?.....( ) 2
3. Look at Fig. II (at the right). What number is in the rectangle but not in the circle nor in the triangle?.....( ) 3
4. What number in Fig. II is in the rectangle and in the triangle but not in the circle? ( ) 4

(The remaining questions all refer to Fig. II.)

5. What number is in the circle and in the rectangle and in the triangle?.....( ) 5
6. What is the smallest number that is in the triangle but not in the circle nor in the rectangle?.....( ) 6
7. What is the largest number that is in the circle but not in the triangle nor in the rectangle?.....( ) 7
8. Write the number that is in the lowest space that is in the triangle and in the circle but not in the rectangle.....( ) 8
9. Find the geometrical figure (circle, triangle, or rectangle) that has the least number of spaces in it. Write that number of spaces.....( ) 9
10. How many spaces are there each of which is in all three geometric figures?.....( ) 10
11. How many spaces are there each of which is in one and only one geometric figure?..( ) 11
12. How many spaces are there each of which is in two and only two geometric figures?( ) 12
13. We may say that space 12 is *like* space 3 because they are *both* in the circle and triangle but not in the rectangle. Any space is *like* another which is in exactly the same geometrical figures. Write the number of the space which is like space 6.....( ) 13
14. Write the number of the space which is like space 1.....( ) 14
15. How many other spaces are there like space 9?.....( ) 15
16. There is no other space like space 5, so we may call space 5 *unique* (yūneek). Any space is unique which has no other space like it. Examine spaces 8, 9, 10, 11, 12, and 13 in order until you find another unique space. Write its number.....( ) 16
17. How many unique spaces are there in Fig. II?.....( ) 17
18. What is the greatest number of unique spaces which it is possible to make by overlapping a circle, triangle, and rectangle? (You may draw any figures you wish on the margin of this page).....( ) 18
19. Also what is the least number of unique spaces possible?.....( ) 19
20. What is the greatest number of spaces which it is possible to make by overlapping a circle, triangle, and rectangle?.....( ) 20

Score.....

TEST 7

Analogies

Samples:
- finger : hand — toe : (?) ..... foot, knee, arm, shoe, nail
- clothes : man — fur : (?) ..... coat, animal, hair, skin, cloth
- tall : short — fat : (?) ..... man, wide, thin, boy, heavy

DIRECTIONS. The first sample means: Finger is to hand as toe is to what? Underline the word on each line that should go in the parenthesis in place of the question mark.

Begin here:

1. hand : arm — foot : (?) ..... leg, toe, finger, wrist, elbow 1
2. peeling : banana — shell : (?) ..... skin, orange, egg, juice, ripe 2
3. wool : sheep — feathers : (?) ..... pillow, rabbit, bird, goat, bed 3
4. coal : locomotive — (?) : automobile .... motorcycle, smoke, wheels, gasoline, horn 4
5. man : woman — brother : (?) ..... daughter, sister, boy, mother, son 5
6. automobile : wagon — motorcycle : (?) .. walking, horse, buggy, train, bicycle 6
7. hospital : the sick — (?) : criminals ..... doctor, asylum, judge, prison, sentence .. 7
8. hat : head — thimble : (?) ..... finger, needle, thread, hand, sewing 8
9. captain : ship — mayor : (?) ..... state, council, city, ship, boss 9
10. better : good — worse : (?) ..... very good, medium, bad, much worse, best 10
11. grass : cattle — bread : (?) ..... butter, flour, milk, man, horses 11
12. large : object — loud : (?) ..... soft, small, heavy, weight, sound 12
13. king : kingdom — president : (?) ..... vice president, senate, republic, queen, democrat 13
14. revolver : man — (?) : bee ..... wings, honey, flying, wax, sting 14
15. egg : bird — (?) : plant ..... seed, shell, leaf, root, feathers 15
16. education : ignorance — (?) : poverty ... laziness, school, wealth, charity, teacher . 16
17. circle : square — sphere : (?) ..... circumference, cube, round, corners, ball 17
18. point : line — line : (?) ..... surface, pencil, dot, curve, solid 18
19. sanitation : disease — (?) : accident ..... doctor, hospital, bandage, cleanliness, care 19
20. ordinary : exceptional — many : (?) .... all, none, few, common, more 20
21. sunlight : darkness — (?) : stillness ..... quiet, sound, dark, loud, moonlight 21
22. peninsula : land — (?) : ocean ..... river, lake, cape, gulf, water 22
23. ellipse : circle — (?) : square ..... cube, curve, oval, circle, diamond 23
24. violence : anger — (?) : love ..... caressing, hate, temper, hope, happiness 24
25. evolution : revolution — crawl : (?) ..... baby, floor, stand, run, hands and knees 25

Score .....

TEST 8

Similarities Test

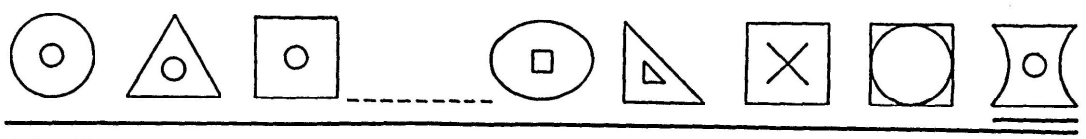
Samples:
- hat, collar, glove.....hand, cane, head, shoe, house
- rose, daisy, violet.....bush, red, plant, bed, pansy
- desk, bed, chair.....book, table, floor, pencil, coat

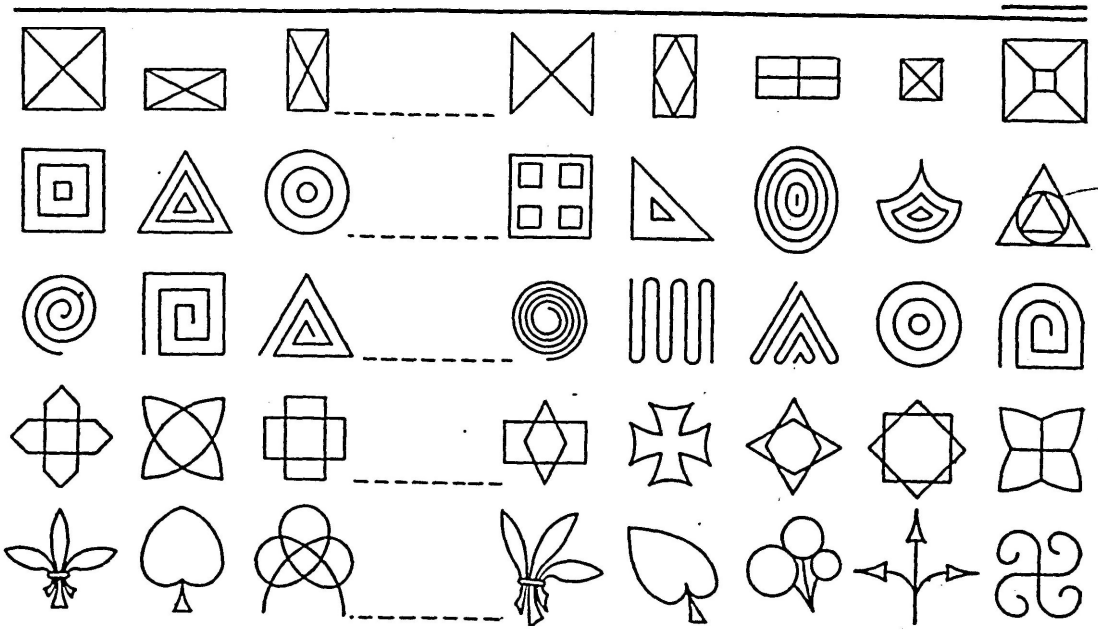
DIRECTIONS. Find the way in which the first three things on a line are alike. Then look at the five other things on the same line and draw a line under the one that is *most* like the first three.

1. red, white, green.....rose, paper, grass, soft, blue..... 1
2. apple, peach, pear.....seed, tree, plum, juice, peel..... 2
3. pan, bowl, basket.....pail, handle, knife, fork, spoon..... 3
4. snake, cow, sparrow.....tree, doll, pig, feather, skin..... 4
5. ship, bicycle, carriage.....sail, automobile, wheel, ocean, harness 5
6. cannon ball, wire, penny.....dollar bill, bone, string, pencil, key... 6
7. president, captain, general.....ship, army, king, republic, soldier.... 7
8. book, teacher, newspaper.....pencil, magazine, ink, card, box. 8
9. ax, knife, shears.....hammer, razor, hoe, rake, fork 9
10. ivory, snow, milk.....butter, rain, cold, cotton, water 10
11. day, say, gay.....night, said, joy, happy, lay..... 11
12. nut, turnip, potato.....shell, tree, bush, milk, apple..... 12
13. strong, bad, fast.....and, man, soon, round, come..... 13
14. generous, kind, honest.....strong, selfish, wise, loyal, rich..... 14
15. joy, anger, fear.....habit, memory, hate, life, hearing.... 15

Continue below in the same way.

Sample:





Score.....

TEST 9

Narrative Completion

DIRECTIONS. For each numbered blank in the story, choose the best word of the three in the list having the same number as the blank. Underline the word you choose. You may write these words in the blank spaces if you wish but only the underlining counts. Do nothing about the blanks that are not numbered.

The Reward of Kindness

Once upon a ..... there was a ..... (1) that lived in a ..... (2) One ..... (3) as he was roaming about, he stepped on a ..... and it stuck in his ..... (4) In great pain he ..... (5) out of the ..... in search of some one who (6) would ..... out the .....

At last he saw a ..... and went up to him as if to say, "..... (7) pull this ..... out of my ....." The ..... saw what was the ..... and was so ..... (8) to see the lion suffer that he forgot to be frightened. Very ..... he pulled the thorn out of the lion's foot. The (9) ..... was so ..... that he ..... (10) the shepherd's ..... and went away without ..... (11) him.

Not long after, the ..... (12) was blamed for a cruel deed which he had not ..... The ..... said: "He ..... (13) die. Throw ..... into the lion's den (14)." So the king's men .... shepherd and put him into the ..... with a great ..... It was the very ..... the shepherd had (15) ..... near the forest. And lo! Instead of ..... the ....., the lion only licked his (16) hand.

The ..... was amazed. He ..... the shepherd to ..... his power over (17) the ..... Then the .... (18) how he had ..... the ..... of .... Upon ..... this, the (19) ..... said, "This man .... (20) no ..... deed. Let him go." (21) So the .... freed and after that no (22) .... him of (23) .... Have you heard this story before? (24) (25) .....

1.	time	place	man	1
2.	man	lion	dog	2
3.	street	garden	forest	3
4.	tack	thorn	rock	4
5.	back	hand	foot	5
6.	came	limped	ran	6
7.	shepherd	hunter	woodsman	7
8.	glad	sorry	anxious	8
9.	gently	nicely	suddenly	9
10.	angry	hungry	grateful	10
11.	hand	sheep	dog	11
12.	eating	thanking	harming	12
13.	hunter	king	people	13
14.	must	may	will	14
15.	man	shout	lion	15
16.	fighting	killing	helping	16
17.	lion	shepherd	king	17
18.	explain	give	keep	18
19.	softened	relieved	satisfied	19
20.	hunger	anger	suffering	20
21.	king	people	men	21
22.	cruel	kind	good	22
23.	dog	lion	shepherd	23
24.	knew	accused	hurt	24
25.	many	other	cruel	25

Underline words here

Score.....

TEST 10

Memory

DIRECTIONS. Read each question and if the right answer, according to the story, is *yes*, draw a line under the word *yes*. If the right answer is *no*, draw a line under the word *no*. But if you do not know the right answer, because the story didn't say, draw a line under the words *didn't say*.

Samples:
- Was the story about a king?..... (yes no didn't say)
- Was the king's daughter sixteen years old?..... (yes no didn't say)
- Was she ugly?..... (yes no didn't say)

Begin here:

1. Was the king fond of hearing stories?..... (yes no didn't say) 1
2. Did the king offer his daughter to any one who could tell him a story that would last forever?..... (yes no didn't say) 2
3. Did he offer all his kingdom also?..... (yes no didn't say) 3
4. Did he say, "but if he fails he shall be cast into prison"?..... (yes no didn't say) 4
5. Was the king's daughter pretty?..... (yes no didn't say) 5
6. Did she like stories, too?..... (yes no didn't say) 6
7. Did the story say that after a long time a young man came and offered to tell the king a story?..... (yes no didn't say) 7
8. Did the first man's story last a week?..... (yes no didn't say) 8
9. Was the first man's head cut off?..... (yes no didn't say) 9
10. Did the king then order another man to tell him a story?..... (yes no didn't say) 10
11. Did each man's story last longer than that of the one before?..... (yes no didn't say) 11
12. Were all the young men who came to tell stories handsome?..... (yes no didn't say) 12
13. Did a handsome young man say to the king, "I can tell you a story that will last forever"?..... (yes no didn't say) 13
14. Did the king beg the young man not to try?..... (yes no didn't say) 14
15. Was the king's daughter afraid he would fail?..... (yes no didn't say) 15
16. Did she love him and so not want to see him killed?..... (yes no didn't say) 16
17. Did the young man tell the princess to have no fear?..... (yes no didn't say) 17
18. According to the young man's story, did a rich man order a huge granary built?..... (yes no didn't say) 18
19. Did he have it filled with oats to the very tip-top?..... (yes no didn't say) 19
20. Was a very small hole left between the bricks near the ground?..... (yes no didn't say) 20
21. Was the hole just big enough to let one little ant through?..... (yes no didn't say) 21
22. Did the young man say that one day a little ant went in and carried off a grain of wheat?..... (yes no didn't say) 22
23. Did he say that the next day another little ant went in and carried off another grain of wheat?..... (yes no didn't say) 23
24. Did the king plead with the young man to tell him what happened after that?..... (yes no didn't say) 24
25. Did the young man say, "Why, after that the ants just kept on carrying off the wheat"?..... (yes no didn't say) 25
26. Did the king finally say, "Man, man, your story will last forever"?(yes no didn't say) 26
27. Did he say, "Take my daughter and half my kingdom and don't speak to me again"?..... (yes no didn't say) 27
28. Did the young man marry the princess?..... (yes no didn't say) 28
29. Did the king ever want to hear another story..... (yes no didn't say) 29
30. Was the name of this story, "The story that had no end"?..... (yes no didn't say) 30

Have you heard this story before?..... (yes no)

Score.....

FORM 7 GROUP EXAMINATION ALPHA GROUP NO.....

Name..... Rank..... Age.....

Company..... Regiment..... Arm..... Division.....

In what country or state born?..... Years in U. S.?..... Race.....

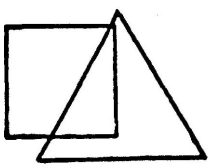
Occupation..... Weekly Wages.....

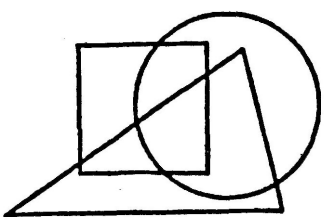
Schooling: Grades, 1. 2. 3. 4. 5. 6. 7. 8: High or Prep. School, Year 1. 2. 3. 4: College, Year 1. 2. 3. 4.

TEST 1

1. ○ ○ ○ ○ ○

2. (1) (2) (3) (4) (5) (6) (7) (8) (9)

3. 

4. 

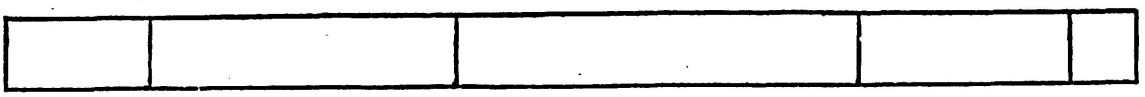
5. ○ ○ ○ Yes No

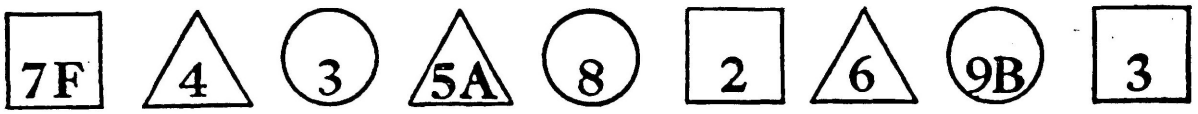
6. ○ ○ ○ ○ ○

7. A B C D E F G H I J K L M N O P

8. ○ ○ ○ MILITARY GUN CAMP

9. 34-79-56-87-68-25-82-47-27-31-64-93-71-41-52-99

10. 

11. 

12. 1 2 3 4 5 6 7 8 9

Division of Psychology, Medical Department U. S. A.
Authorized by the Surgeon General, Feb. 8, 1918, Edition, Aug. 16, 1918, 200,000.

TEST 8

Notice the sample sentence:

People hear with the eyes <u>ears</u> nose mouth

The correct word is ears, because it makes the truest sentence.

In each of the sentences below you have four choices for the last word. Only one of them is correct. In each sentence draw a line under the one of these four words which makes the truest sentence. If you can not be sure, guess. The two samples are already marked as they should be.

SAMPLES
People hear with the eyes <u>ears</u> nose mouth
France is in <u>Europe</u> Asia Africa Australia

1 Bull Durham is the name of a chewing gum aluminum ware tobacco clothing..... 1
2 Seven-up is played with rackets cards pins dice..... 2
3 The Merino is a kind of horse sheep goat cow..... 3
4 The most prominent industry of Minneapolis is flour brewing automobiles packing.. 4
5 Garnets are usually yellow blue green red..... 5

6 The Orpington is a kind of fowl horse granite cattle..... 6
7 George Ade is famous as a baseball player comic artist actor author..... 7
8 Soap is made by B. T. Babbitt Smith & Wesson W. L. Douglass H. J. Heinz Co.... 8
9 Laura Jean Libby is known as a singer suffragist writer army nurse..... 9
10 "Eventually—why not now?" is an "ad" for a revolver cleanser flour automobile.... 10

11 Alfalfa is a kind of hay corn fruit rice..... 11
12 The rutabaga is a lizard vegetable fish snake..... 12
13 Harvard University is in Annapolis Cambridge Ithaca New Haven..... 13
14 Calcutta is a city in Egypt China India Japan..... 14
15 Pearls are obtained from mines elephants reefs oysters..... 15

16 McDowell is famous as a composer sculptor poet painter..... 16
17 The penguin is a bird fish reptile insect..... 17
18 The larynx is in the head neck abdomen shoulder..... 18
19 Peruna is a disinfectant food product patent medicine tooth paste..... 19
20 The U. S. S. Nebraska is a destroyer monitor submarine battleship..... 20

21 The howitzer is a kind of musket sword cannon pistol..... 21
22 The Burroughs is a kind of multigraph adding machine phonograph typewriter..... 22
23 Cerise is a color drink fabric food..... 23
24 The cymbal is used in music stenography book-binding lithography..... 24
25 Pongee is a food dance fabric drink..... 25

26 The author of "Barrack Room Ballads" is Poe Stevenson Hawthorne Kipling..... 26
27 Joseph Choate was a merchant engineer lawyer scientist..... 27
28 An air-cooled engine is used in the Buick Packard Franklin Ford..... 28
29 Henry VIII's wives numbered 4 5 6 7 8 9..... 29
30 Newton was the most famous in science politics literature war..... 30

31 Portia is in Vanity Fair Romola The Christmas Carol The Merchant of Venice..... 31
32 The number of a Hottentot's legs is two four six eight..... 32
33 Homicide is a term used in medicine law theology pedagogy..... 33
34 A dibble is used in fishing hunting athletics farming..... 34
35 Lob is a term used in football hockey golf tennis..... 35

36 The Spanish-American War started in 1890 1898 1904 1914..... 36
37 The ohm is used in measuring rainfall wind power electricity water power..... 37
38 The Rolls-Royce car is made in England France Canada United States..... 38
39 Bile is made in the spleen kidneys stomach liver..... 39
40 A five-sided figure is called a scholium pentagon parallelogram trapezium..... 40

TEST 2

Get the answers to these examples as quickly as you can. Use the side of this page to figure on if you need to.

SAMPLES
1 How many are 5 men and 10 men?.....Answer (15)
2 If you walk 4 miles an hour for 3 hours, how far do you walk?.....Answer (12)

1 How many are 50 tents and 8 tents?.....Answer ( )
2 If you save $5 a month for 7 months, how much will you save?.....Answer ( )
3 If 40 men are divided into squads of 8, how many squads will there be?.....Answer ( )
4 Mike had 12 cigars. He bought 2 more and then smoked 7. How many cigars did he have left?.....Answer ( )
5 A company advanced 7 miles and retreated 2 miles. How far was it then from its first position?.....Answer ( )
6 How many hours will it take a truck to go 65 miles at the rate of 5 miles an hour?.....Answer ( )
7 How many pencils can you buy for 30 cents at the rate of 2 for 5 cents?.....Answer ( )
8 A regiment marched 40 miles in five days. The first day they marched 9 miles, the second day 6 miles, the third 10 miles, the fourth 11 miles. How many miles did they march the last day?.....Answer ( )
9 If you buy 2 packages of tobacco at 7 cents each and a pipe for 55 cents, how much change should you get from a two-dollar bill?.....Answer ( )
10 If it takes 7 men 2 days to dig a 140-foot drain, how many men are needed to dig it in half a day?.....Answer ( )
11 A dealer bought some mules for $1,000. He sold them for $1,200, making $20 on each mule. How many mules were there?.....Answer ( )
12 A rectangular bin holds 300 cubic feet of lime. If the bin is 10 feet long and 5 feet wide, how deep is it?.....Answer ( )
13 A recruit spent one-eighth of his spare change for post cards and four times as much for a box of letter paper, and then had 30 cents left. How much money did he have at first?...Answer ( )
14 If 4½ tons of clover cost $36, what will 2½ tons cost?.Answer ( )
15 A ship has provisions to last her crew of 800 men 4 months. How long would it last 1,200 men?.....Answer ( )
16 If a train goes 150 yards in 10 seconds, how many feet does it go in a fifth of a second?.....Answer ( )
17 A U-boat goes 10 miles an hour under water and 20 miles an hour on the surface. How long will it take to cross a 100-mile channel if it has to go one-fifth of the way under water? Answer ( )
18 If 341 squads of men are to dig 6,138 yards of trench, how many yards must be dug by each squad?.....Answer ( )
19 A certain division contains 4,000 artillery, 15,000 infantry, and 1,000 cavalry. If each branch is expanded proportionately until there are in all 22,000 men, how many will be added to the artillery?.....Answer ( )
20 A commission house which had already supplied 1,897 barrels of apples to a cantonment delivered the remainder of its stock to 27 mess halls. Of this remainder each mess hall received 56 barrels. What was the total number of barrels supplied? Answer ( )

TEST 7

SAMPLES
- sky—blue : : grass— table **green** warm big
- fish—swims : : man— paper time **walks** girl
- day—night : : white— red **black** clear pure

In each of the lines below, the first two words are related to each other in some way. What you are to do in each line is to see what the relation is between the first two words, and underline the word in heavy type that is related in the same way to the third word. Begin with No. 1 and mark as many sets as you can before time is called.

1	bird—sings : : dog— fire barks snow flag	1
2	eat—bread : : drink— water iron lead stones	2
3	father—son : : mother— aunt nephew daughter sister	3
4	heehaw—donkey : : bow-wow— hen cat speech dog	4
5	engineer—locomotive : : chauffeur— drive auto horse wagon	5
6	love—hatred : : friend— lover mother need enemy	6
7	wrist—bracelet : : neck— collar leg foot giraffe	7
8	sailor—navy : : soldier— gun private army fight	8
9	carpenter—house : : shoemaker— hatmaker wax shoe awl	9
10	shoestring—shoe : : button— coat catch bell hook	10
11	quinine—bitter : : sugar— cane sweet salt beets	11
12	tiger—wild : : cat— dog mouse tame pig	12
13	legs—man : : wheels— spokes carriage go tire	13
14	north—south : : east— north west south east	14
15	feather—float : : rock— ages hill sink break	15
16	grass—cattle : : bread— man butter water bones	16
17	fin—fish : : wing— feather air bird sail	17
18	paper—wall : : carpet— tack grass sweep floor	18
19	food—man : : fuel— engine burn coal wood	19
20	sled—runner : : buggy— horse carriage harness wheel	20
21	poison—death : : food— eat bird life bad	21
22	Japanese—Japan : : Chinese— Russia China Japanese pigtail	22
23	angels—heaven : : men— earth women boys Paradise	23
24	Washington—Adams : : first— contrast best second last	24
25	prince—princess : : king— palace queen president kingdom	25
26	able—unable : : strong— weak able big ox	26
27	add—subtract : : multiply— add divide arithmetic increase	27
28	past—present : : yesterday— today tomorrow Christmas gone	28
29	birth—death : : planting— corn spring harvest wheat	29
30	horse—mule : : obedient— disgraceful donkey stubborn obey	30
31	writer—books : : bee— hive honey wasp sting	31
32	light—dark : : noise— report ring silence sound	32
33	behind—late : : before— after soon early dinner	33
34	northpole—equator : : frigid— cool Canada cold torrid	34
35	success—failure : : joy— pleasure sadness work fun	35
36	prosperity—happiness : : adversity— success sorrow fun rage	36
37	character—important : : complexion— trivial blonde brunette good	37
38	imitate—invent : : copy— write pencil originate draw	38
39	advice—command : : persuasion— help aid urging compulsion	39
40	Wednesday—week : : July— August month hot year	40

TEST 3

This is a test of common sense. Below are sixteen questions. Three answers are given to each question. You are to look at the answers carefully; then make a cross in the square before the best answer to each question, as in the sample:

SAMPLE
Why do we use stoves? Because
- ☐ they look well
- ☒ they keep us warm
- ☐ they are black

Here the second answer is the best one and is marked with a cross. Begin with No. 1 and keep on until time is called.

1 Why are chairs made of wood? Because
- ☐ wood is cheap and light
- ☐ wood burns
- ☐ wood is easily broken

2 If a person asks you for something you do not have
- ☐ tell him to mind his business
- ☐ say you don't have it
- ☐ walk away

3 If it rains when you are starting to go for the doctor, what should you do?
- ☐ stay at home
- ☐ take an umbrella
- ☐ wait until it stops raining

4 If you are in danger of sunstroke what should you do?
- ☐ take off your shoes
- ☐ run to the hospital
- ☐ get in the shade or wet your head

5 If you find a man who has hanged himself, you should
- ☐ send a notice to the paper
- ☐ take him home
- ☐ call a doctor or the police

6 Why is tennis good exercise? Because
- ☐ it calls for vigorous movement
- ☐ it demands clear eyes
- ☐ it is very exciting

7 If while on the march you get bitten by a rattlesnake, you should
- ☐ kill the snake
- ☐ suck the poison from the wound
- ☐ run back to camp and get some whiskey

8 If you are hurrying in an auto to catch a train and come to a broken bridge, what should you do?
- ☐ go around and try another road
- ☐ take off your clothes and swim across
- ☐ hire a horse and ride across

☛ Go to No. 9 above

9 Why do some people think that short men should be admitted to the army? Because
- ☐ usefulness does not depend on height
- ☐ they want to enlist
- ☐ they are more intelligent than tall men

10 If you find a lost 2-year-old baby on a city street, what should you do?
- ☐ ask him where he lives and take him there
- ☐ if he is a nice child take him home and keep him
- ☐ ask the police to help you or leave him with them

11 Electric lights are better than gas lights because electricity
- ☐ makes a white light
- ☐ is safer and more convenient
- ☐ is cheaper

12 Why is a check better than real money? Because
- ☐ checks are cleaner than bills
- ☐ you can have all the money you need by writing checks
- ☐ checks are safer and more convenient

13 Five P. M. is the rush hour on street cars because
- ☐ work people are going home at that hour
- ☐ so many people live in the suburbs
- ☐ street cars are the best cheap means of transportation

14 Why should people not waste food in time of war?
- ☐ we could eat less and not starve
- ☐ food is scarce in wartime
- ☐ food costs money

15 You should not give money to beggars on the street because
- ☐ it makes it hard for the beggars to get work
- ☐ it takes away the work of organized charities
- ☐ it encourages living off others

16 A country should have many railroads, because
- ☐ they decrease the price of food materials
- ☐ they make it easy to travel and carry goods
- ☐ they are good for the steel business

TEST 6

SAMPLES	2	4	6	8	10	12	*14*	*16*
	9	8	7	6	5	4	*3*	*2*
	2	2	3	3	4	4	*5*	*5*
	1	7	2	7	3	7	*4*	*7*

Look at each row of numbers below, and on the two dotted lines write the two numbers that should come next.

2	3	4	5	6	7	.....	.....
10	9	8	7	6	5	.....	.....
5	10	15	20	25	30	.....	.....
8	8	6	6	4	4	.....	.....
6	9	12	15	18	21	.....	.....
9	1	7	1	5	1	.....	.....
3	7	11	15	19	23	.....	.....
4	5	8	9	12	13	.....	.....
25	25	21	21	17	17	.....	.....
1	2	4	8	16	32	.....	.....
21	18	16	13	11	8	.....	.....
12	14	13	15	14	16	.....	.....
3	4	6	9	13	18	.....	.....
16	12	15	11	14	10	.....	.....
25	24	22	21	19	18	.....	.....
16	8	4	2	1	½	.....	.....
1	4	9	16	25	36	.....	.....
21	18	16	15	12	10	.....	.....
15	16	14	17	13	18	.....	.....
4	8	10	20	22	44	.....	.....

TEST 4

If the two words of a pair mean the same or nearly the same, draw a line under *same*. If they mean the opposite or nearly the opposite, draw a line under *opposite*. If you cannot be sure, guess. The two samples are already marked as they should be.

SAMPLES
- good—bad..... same—opposite
- little—small..... same—opposite

1	white—black	same—opposite	1
2	cry—laugh	same—opposite	2
3	flat—level	same—opposite	3
4	heaven—hell	same—opposite	4
5	accept—take	same—opposite	5
6	slim—slender	same—opposite	6
7	asleep—awake	same—opposite	7
8	comfort—console	same—opposite	8
9	pigmy—dwarf	same—opposite	9
10	beg—entreat	same—opposite	10
11	concede—deny	same—opposite	11
12	cautious—heedless	same—opposite	12
13	congregate—assemble	same—opposite	13
14	contradict—confirm	same—opposite	14
15	appeal—beseech	same—opposite	15
16	legible—readable	same—opposite	16
17	amiable—surly	same—opposite	17
18	cleave—split	same—opposite	18
19	convoke—dismiss	same—opposite	19
20	docile—refractory	same—opposite	20
21	dearth—scarcity	same—opposite	21
22	besmirch—cleanse	same—opposite	22
23	hoax—deception	same—opposite	23
24	colleague—adversary	same—opposite	24
25	irksome—refreshing	same—opposite	25
26	lucrative—profitable	same—opposite	26
27	momentous—immaterial	same—opposite	27
28	contingent—dependent	same—opposite	28
29	indict—arraign	same—opposite	29
30	prefix—append	same—opposite	30
31	essential—fundamental	same—opposite	31
32	ligature—band	same—opposite	32
33	myopia—hyperopia	same—opposite	33
34	motile—sessile	same—opposite	34
35	amenable—tractable	same—opposite	35
36	diatribe—invective	same—opposite	36
37	obdurate—stubborn	same—opposite	37
38	profligate—ascetic	same—opposite	38
39	preamble—peroration	same—opposite	39
40	pertinacious—obstinate	same—opposite	40

TEST 5

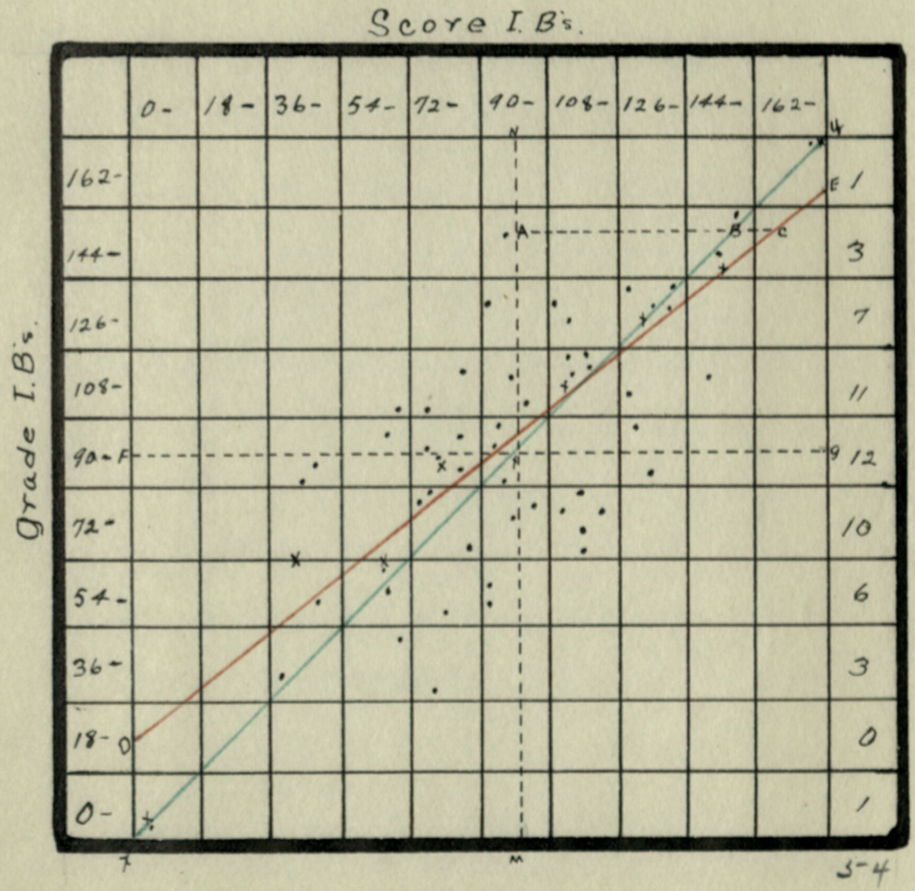
The words A EATS COW GRASS in that order are mixed up and don't make a sentence; but they would make a sentence if put in the right order: A COW EATS GRASS, and this statement is true.

Again, the words HORSES FEATHERS HAVE ALL would make a sentence if put in the order ALL HORSES HAVE FEATHERS, but this statement is false.

Below are twenty-four mixed-up sentences. Some of them are true and some are false. When I say "go," take these sentences one at a time. Think what each would say if the words were straightened out, but don't write them yourself. Then, if what it would say is true, draw a line under the word "true"; if what it would say is false, draw a line under the word "false." If you can not be sure, guess. The two samples are already marked as they should be. Begin with No. 1 and work right down the page until time is called.

SAMPLES	a eats cow grass	true	false	
	horses feathers have all	true	false	
1	dogs meat eat	true	false	1
2	see are with to eyes	true	false	2
3	trees the fish in swim	true	false	3
4	harness paper of made is	true	false	4
5	money marry always for men	true	false	5
6	hump camel has a his a back on	true	false	6
7	flag the English same the as is the American	true	false	7
8	and cows from honey come bread	true	false	8
9	young nurse their cats	true	false	9
10	earth is mined coal the from	true	false	10
11	property floods life and destroy	true	false	11
12	grow and apples ground oranges the in	true	false	12
13	time in soldiers war trees in sleep	true	false	13
14	of Congress laws the makes our nation	true	false	14
15	true bought cannot friendship be	true	false	15
16	temperatures freezes water high at	true	false	16
17	judges just all be to ought	true	false	17
18	health necessary camp a is to clean	true	false	18
19	happiness source of always a crime is	true	false	19
20	bell most telephones have attached a	true	false	20
21	brings avarice man friends a	true	false	21
22	seen can the moon nights not be some	true	false	22
23	and emotions sorrow similar grief are	true	false	23
24	cardinal not cultivated virtues the be should	true	false	24

Graph explaining the meaning of r.



D.E. = Correction line.

X.Y. = Line of perfect correlation.

F.G. = Median.

M.N. = Median.

$\frac{A.B.}{A.C.}$ = r = .671.

The dots representing each individuals grade I.B. and score I.B. are graphically located in the squares. The next step is to find the line representing the medians for the grade I.B.s and score I.B.s. To locate the median for the grade I.B.s the number of students grouped in each horizontal row is placed at the end of each row which counting from the bottom gives I, 0, 3, 6, 10, 12, 11, 7, 3, I or 54 in all. Now the median line means such a line that there will be as many individuals found above the line as there are below it. In this case there should be 27 above and 27 below. Counting up from the bottom we find that this line lies somewhere in the row which contains twelve individuals. There are 20 below this interval hence 7 of these 12 belong below the median, that is the median will divide this interval so 7/12 of the interval will be below the median and 5/12 above it. The other median is found in a like manner. Line xy is drawn for the line of perfect correlation and since in this case the rows and columns are equal in width forming squares the line xy will be a line forming an angle of 45 degrees. It passes through all points where the grade I.B. is equal to the corresponding score I.B. Line De shows the correlation of the grade I.B. and score I.B. of this particular group of students. The mean value of the points in each column is found and marked with a cross.

There are as many individuals in the column above the cross as there are below. Line DE is the line that passes through or nearest to the greatest number of crosses. The nearness to which this line DE approaches the line of perfect correlation xy represents the coefficient of correlation and can be found by drawing a line abc perpendicular to median mn. Then the fraction ab/ac represents the value of the coefficient of correlation. In this case it is .671. It may be that this number is not the true coefficient of correlation. It may be slightly larger or slightly smaller than this value. However we have a method of finding the reliability of such a coefficient of correlation. This measure of the reliability of the coefficient of correlation is called the Probable Error P. E., and is a measure of the limits above or below the coefficient found that will include 50% of the later values found for this same coefficient. The P. E. of the Coefficient of correlation is found by employing the following formula. P. E. $= \pm \frac{.6745(1-r^2)}{\sqrt{N}}$ N stands for the number of measures involved. In writing the Coefficient of correlation it is generally customary to give the P. E. also, In the particular case given above the P. E. is $\pm$ .05 so it would be written with the coefficient of correlation thus: .671 $\pm$ .05. In the

above pages an attempt is made to explain in a graphical way, what is meant by the term Coefficient of correlation. Following this an illustrative problem, with its explanation, is given showing the mathematical process by which the coefficient of correlation is found. The problem given is based on the comparison of the school grade I.B's and the test score I.B's of the entire high school group.

An illustrative problem showing the method of finding r.

	0-	18-	36-	54-	72-	90-	108-	126-	144-	162-	f	d	fd	fd^2	$\Sigma x'y'$
162-										1	1	4	4	16	16
144-						1			2		3	3	9	27	18
126-						1	2	4			7	2	14	28	20
108-				1	2	2	4	1	1		11	1	11	11	5
90-			2	1	4	3		2			12	0			
72-					3	3	3	1			10	-1	-10	10	-2
54-			1	2		3					6	-2	-12	24	14
36-			1	1	1						3	-3	-9	27	18
18-											0	-4	0	0	0
0-	1										1	-5	-5	25	25
f	1	0	4	5	10	13	9	8	3	1	54		2	164	114
d	-5	-4	-3	-2	-1		1	2	3	4					
fd	-5	0	-12	-10	-10		9	16	9	4	1				
fd^2	25	0	36	20	10		9	32	27	16	175				

$$C_y = \frac{fd}{N} = \frac{2}{54} = .039.$$

$$C_x = \frac{fd}{N} = \frac{1}{54} = .018$$

$$C_y^2 = (.039)^2 = .015$$

$$C_x^2 = (.018)^2 = .0003$$

$$\sigma_y^2 = \frac{fd_y^2}{N} = \frac{164}{54} = 3.037.$$

$$\sigma_x^2 = \frac{fd_x^2}{N} = \frac{175}{54} = 3.24.$$

$$\sigma_y^2 = \sigma_y^2 - C_y^2 = 3.037 - .015 = 3.022.$$

$$\sigma_x^2 = \sigma_x^2 - C_x^2 = 3.24 - .0003 = 3.2397.$$

$$\sigma_y = \sqrt{3.022} = 1.739$$

$$\sigma_x = \sqrt{3.2397} = 1.799$$

$$\frac{\Sigma x'y'}{N} = \frac{114}{54} = 2.111.$$

$$C_x C_y = .039 - .018 = .0007$$

$$\frac{\Sigma x'y'}{N} C_x C_y = 2.111 - .0007 = 2.1103.$$

$$P.E. = \pm \frac{.6745(1-r^2)}{\sqrt{N}} = \pm \frac{.6745(1-.45)}{7.34} = \frac{.6745(.55)}{7.34}$$

$$= \frac{.37}{7.34} = \pm .050$$

$$r = \frac{\frac{\Sigma x'y'}{N} - C_x C_y}{\sigma_x \sigma_y} = \frac{2.11}{3.128} = .671 \pm .050$$

An Explanation of the Illustrative Problem Given on the Preceding Page.

Each individual involved in the comparison is graphically located in the proper square according to his grade I.B and score I.B. The sum of all the individuals in each row is placed at the end of the row in the column headed f, called the frequency column. At the bottom of this column the sums are totaled which is 54 in this case. This number 54 will be spoken of as N. The norm represented by the dotted line is so drawn that there will be as many individuals above it as there are below it. The column headed d shows the deviation of each row from the norm. Fd is the product of the frequency and deviation while fd^2 is this product multiplied by the deviation. The last column headed by x'y' contains the product sum of the x's and y's and is found thus, Let us take the first row above the row containing the norm. The first square to the right contains 4 so we take 1 x 4 = 4, the second square contains 1 so we take 2x1=2, the third square gives 3x1=3. The first square to the left contains 2 and we have -1x2=-2, (this is minus since those to the left are minus). The second square gives -2x1= 2. Adding all the products we get -4+9 or +5, which is the number found at the end of

of the row beneath the heading x'y'. The others are found in the same way.

The columns headed fd, fd^2 and x'y' are added. The corrections cy and cx are found by dividing fdy and fdx by N. Cy and cx are then squared. The square of the standard deviations around the assumed mean Sy^2 and Sx^2 are found by dividing fdy^2 and fdx^2 by N. The standard deviations σ_x and σ_y are found by subtracting the Cy^2 and Cz^2 from Sy^2 and Sx^2 and taking the square root of the remainder. Then x'y' is divided by N and the product of cx and cy taken from the quotient. This remainder divided by the product of σ_y and σ_x gives r the coefficient of correlation. The P.E. has been explained under the discussion of an analysis of the meaning of the term coefficient of correlation.

Summing this up ~~we have~~, the formulas following *were applied above.*

$$r = \frac{\frac{\Sigma x'y'}{N} - C_x C_y}{\left(\sqrt{\frac{fd_y^2}{N}} - C_y^2\right)\left(\sqrt{\frac{fd_x^2}{N}} - C_x^2\right)} \pm \frac{.6745(1-r^2)}{\sqrt{N}}$$

or

$$r = \frac{\frac{\Sigma x'y'}{N} - C_x C_y}{\sigma_y \sigma_x} \pm \frac{.6745(1-r^2)}{\sqrt{N}}$$

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